## 5. LABELING

**CALL SYMBOL (X, Y, HEIGHT, BCD, THETA, NS)**
**CALL NUMBER (X, Y, HEIGHT, FPN, THETA, NN)**

| | |
|---|---|
| **(X, Y)** | is the coordinate of the lower left corner of the first character to be drawn. |
| **HEIGHT** | is the height of characters to be drawn. |
| **BCD** | is the location of alpha array. |
| **FPN** | is the floating point number. |
| **THETA** | is the angle (degrees) at which the label is to be written. |
| **NS** | is the number of characters in the label. A negative NS will produce a single centered character from the integer reference table and expects BCD to be an integer. |
| **NN** | is the number of decimal digits to the right of the decimal point. A zero value will print the decimal point. A (-1) NN value will suppress the decimal point. |

### NOTE

On some computers NN will not be an integer. NN may assume any of the input/output formats in the form of a literal. For example: 2HI2 for I2 format. 4HF8.2 for an F8.2 format, etc.

6. SPECIAL FUNCTIONS. The basic plotting routine provides several entries. The first entry (off-line plot routines only) is to allocate a work region to the PLOT routine.

**CALL PLOTS (BUFFER, NBUF)**
**CALL PLOTS (BUFFER, NBUF, NTAPE)**

| | |
|---|---|
| **BUFFER** | is the low order core location of the work area. |
| **NBUF** | is the number of words in work area. |
| **NTAPE** | is the logical tape unit for output. (Some versions only; see PLOT listings for more detail.) |

The second entry to PLOT is an instruction to move to the specified page coordinate with pen lifted or lowered. The third argument may also specify a new reference.

**CALL PLOT (XPAGE, YPAGE, IC)**

| | |
|---|---|
| **(XPAGE, YPAGE)** | is an instruction to the plot routine to generate the increments necessary to move pen from the current position to (XPAGE, YPAGE). |
| **IC** | specifies pen up (3) or pen down (2). A negative IC provides a new reference point at (XPAGE, YPAGE) relative to current reference point. |

A third entry is to assist in plotting optimization. This entry provides current plotter position.

**CALL WHERE (XP, YP, FCTR)**

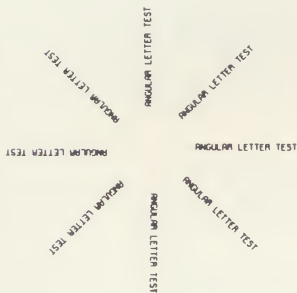| | |
|---|---|
| **(XP, YP)** | are filled with the current pen location upon return from the PLOT routine. |
| **(FCTR)** | is current multiplying factor being used by PLOT. (See PLOT listings for details.) |

Additional entries are available in several computer programs. Some of these entries provide factors, offsets and block addresses.
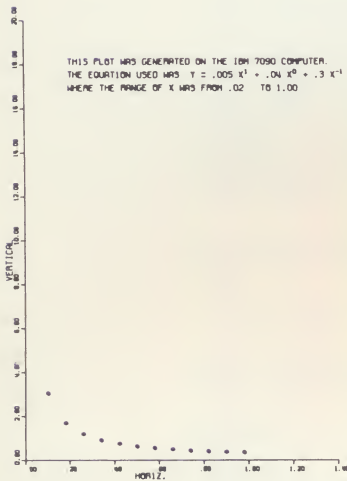
# III. SAMPLE PROBLEM



TABLE 2-A
CHARACTERS AVAILABLE IN SYMBOL ROUTINE (IBM 7090)
BI-OCTAL EQUIVALENCE / INTEGER EQUIVALENCE
REFERENCE LOWER LEFT CORNER / REFERENCE CENTER

Plot 1



Plot 2



THIS PLOT WAS GENERATED ON THE IBM 7090 COMPUTER.
THE EQUATION USED WAS $Y = .005 X^1 + .04 X^0 + .3 X^{-1}$
WHERE THE RANGE OF X WAS FROM .02 TO 1.00

Plot 3



THIS PLOT WAS GENERATED ON THE IBM 7090 COMPUTER.
THE EQUATION USED WAS $Y = .005 X^2 + .04 X^1 + .3 X^0$
WHERE THE RANGE OF X WAS FROM .04 TO 2.00
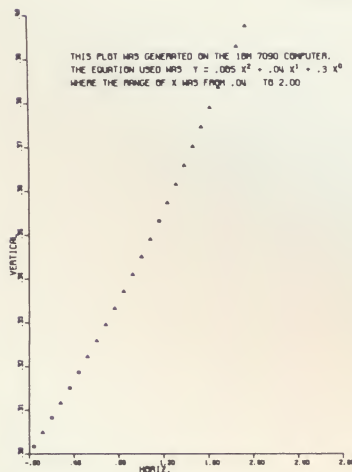
Plot 4

```
      DIMENSION DATA(1024),X(52),Y(52)


      CALL PLOTS (DATA(1024),1024)

      CALL PLOT (0.0,-.5,3)
      CALL PLOT (0.0,10.5,2)
      CALL PLOT (8.5,10.5,2)
      CALL PLOT (8.5,-.5,2)
      CALL PLOT (0.0,-.5,2)

      CALL SYMBOL (1.0,10.3,0.10,10HTABLE 2-A ,0.0,10)
      CALL SYMBOL (1.5,10.0,0.14,50HCHARACTERS AVAILABLE IN SYMBOL ROUTI
     INE (IBM 7090) ,0.0,50)
      CALL SYMBOL (2.15,9.8,0.10,27HBI-OCTAL EQUIVALENCE      ,0.0,20)
      CALL SYMBOL (1.70,9.6,0.10,27HREFERENCE LOWER LEFT CORNER ,0.0,27)
      CALL SYMBOL (5.65,9.8,0.10,27HINTEGER EQUIVALENCE      ,0.0,20)
      CALL SYMBOL (5.80,9.6,0.10,27HREFERENCE CENTER        ,0.0,16)

      N = 0
      DO 100 I = 1,4
      Y = 9.05
      DO 110 J = 1,16
      IJ = N / 8
      CALL NUMBER (1.0,Y,0.14,FLOATF(N+IJ*2),0.0,-1)
      M = N
      GO TO (50,50,60,60),I
60    M = - N
50    CALL SYMBOL (1.50,Y,0.35,M*2**12,0.0,1)
      Y = Y - 0.6
110   N = N + 1

100   CALL PLOT (1.0,0.0,-3)

      N = 0
      DO 120 I = 1,2
      Y = 9.05
      DO 130 J = 1,16
      CALL NUMBER (1.5,Y,0.14,FLOATF(N),0.0,-1)
      CALL SYMBOL (2.0,Y,0.2,N,0.0,-1)
      Y = Y -0.6
130   N = N + 1
120   CALL PLOT (1.0,0.0,-3)
      CALL SYMBOL (1.0,-0.4,0.10,8HPAGE 2-8  ,0.0,8)
      CALL PLOT (3.0,0.0,-3)

      THETA = 0.0
      DO 140 I = 1,8
      TH = THETA * 0.0174533
      CALL SYMBOL (5.+COSF(TH),5.+SINF(TH),.14,19HANGULAR LETTER TEST
     1            ,THETA,19)
140   THETA = THETA +45.0
      CALL PLOT (10.0,0.0,-3)

      DLTX = 0.0
      DO 11 I = 1,5
      DLTX = DLTX * 2.0
      X(1) = DLTX
      DO 21 J = 1,50
      Y(J) = .005*X(J)**I + .04*X(J)**(I-1) + .3*X(J)**(I-2)
21    X(J+1) = X(J) + DLTX
      CALL NUMBER (4.6,8.4,0.14,X(1),0.0,2)
      CALL NUMBER (5.68,8.4,.14,X(50),0.0,2)
      CALL SCALE (X,6.5,50,1)

      CALL SCALE (Y,10.0,50,1)

      CALL LINE (X,Y,50,1,(I-3)*2,I)




      CALL AXIS (0.0,0.0,6HHORIZ.,-6,6.5,0.0,X(51),X(52))


      CALL AXIS (0.0,0.0,8HVERTICAL,8,10.0,90.0,Y(51),Y(52))


      CALL SYMBOL (1.0,9.0,0.14,49HTHIS PLOT WAS GENERATED ON THE IBM
     17090 COMPUTER. ,0.0,49)
      CALL SYMBOL (1.0,8.7,0.14,50HTHE EQUATION USED WAS   Y = .005 X
     1+ .04 X  + .3 X,0.0,50)
      CALL SYMBOL (1.0,8.4,0.14,50HWHERE THE RANGE OF X WAS FROM
     1 TC          ,0.0,50)

      CALL NUMBER (4.96,8.79,0.10,FLOATF(I  ),0.0,-1)
      CALL NUMBER (6.04,8.79,0.10,FLOATF(I-1),0.0,-1)
      CALL NUMBER (7.00,8.79,0.10,FLOATF(I-2),0.0,-1)

11    CALL PLOT (10.0,0.0,-3)

      CALL PLOT (0,0,999)
      CALL EXIT
      END(1,1,0,0,0,0,1,1,0,1,0,0,0,0,0)
```

6

THIS STATEMENT RESERVES A WORK REGION FOR PLOT. IT IS RECOMMENDED THAT
    THIS WORK REGION BE AT LEAST 2000 CHARACTERS. THIS MAY BE AS
    SMALL AS 120 CHARACTERS OR AS LARGE AS 180000 CHARACTERS.
    X AND Y ARE THE ORDINATE AND ABSCISSA ARRAY NAMES. NOTE THAT TWO
    ADDITIONAL ELEMENTS ARE ASSIGNED FOR SCALE AND LINE ROUTINES.

INITIALIZES PLOT ROUTINE WITH LOW ORDER CORE POSITION.(DATA(1) IN FORTRAN IV).

TELLS PLOTTER TO MOVE TO (0.0,-.5) WITH PEN UP (3).

TELLS PLOTTER DRAW PAGE OUTLINE (8.5 X 11). WITH PEN DOWN(2).

PRINTS LEGEND FOR SYMBOL TABLE PLOT AT THE TOP OF THE PAGE.

N VARIES FROM 0 TO 63.(00 OCTAL TO 77 OCTAL)
SET UP FOR FOUR COLUMNS OF CHARACTERS
SET VERTICAL DIMENSION FOR FIRST CHARACTER IN COLUMN.
PICK UP 16 CHARACTERS PER COLUMN
CONSTANT FOR OCTAL NUMBER CALCULATION.
CALLS FOR NUMBER TO BE DRAWN. THE LAST ARGUMENT(-1)SUPPRESSED DECIMAL
SET M TO NEW N VALUE.
SKIP NEXT INSTRUCTION IF NUMBER IS LESS THAN 32 (40 OCTAL)
REPLACE BIT LOST IN CALCULATION (M*2**12).
DRAW THE BCD CHARACTER.
CHANGE VERTICAL POSITION FOR NEXT CHARACTER.
INCREMENT N FOR NEXT CHARACTER IN SYMBOL TABLE.

MOVE TO COORDINATE (1.0,0.0).STORE ZERO INSIDE PLOT ROUTINE. THIS
    ESTABLISHES A NEW REFERENCE POINT.
RESET N TO PICK UP THE CENTERED SYMBOL SET FROM SYMBOL TABLE.
LOOP FOR TWO COLUMNS OF CENTERED SYMBOLS.
SET VERTICAL POSITION OF FIRST CHARACTER IN COLUMN.
LOOP FOR SIXTEEN SYMBOLS IN EACH COLUMN.
PLOT INTEGER ARGUMENT FOR CURRENT CENTERED SYMBOL.
PLOT CURRENT CENTERED SYMBOL.
CHANGE VERTICAL POSITION FOR NEXT SYMBOL IN COLUMN.
INCREMENT N FOR PICKING UP NEXT CENTERED SYMBOL.
REESTABLISH REFERENCE AT (1.0,0.0) FROM CURRENT REFERENCE.
WRITE SCOOP MANUAL PAGE NUMBER.
REESTABLISH REFERENCE OFF OF COMPLETED CHARACTER EQUIVALENCE PAGE.

SET ANGLE EQUAL ZERO FOR A TEST OF ANGULAR LETTERS.
LOOP FOR EIGHT DIFFERENT ANGLES.
CONVERT DEGREES TO RADIANS FOR COS AND SIN FUNCTIONS.
PLOT WHEEL OF LETTERS WITH CENTER AT (5.0,5.0)AND SENTENCE STARTING
    ONE INCH AWAY FROM CENTER.
INCREASE ANGLE FOR NEXT SENTENCE.
REESTABLISH REFERENCE POINT FOR NEXT SAMPLE OUTPUT.

SET VARIABLE (DLTX) TO 0.01,FOR FIRST PASS THRU CURVE EVALUATION.
LOOP TO EVALUATE FIVE CURVES,AND PLOT FIVE GRAPHS
THIS INSTRUCTION CHANGES THE RANGE OF X FOR EACH GRAPH.
SET THE FIRST CELL IN THE ARRAY TO SAME KNOWN VALUE.
LOOP FOR FIFTY POINTS ALONG EQUATION TO BE EVALUATED.
EQUATION TO BE EVALUATED FOR FIVE GRAPHS.
COMPUTE NEXT ELEMENT IN X ARRAY.
PLOT OUT FIRST X VALUE FROM ARRAY. PLOT TO BE TO TWO DECIMAL DIGITS.
PLOT OUT LAST X VALUE FROM ARRAY.
EXAMINE X ARRAY FOR MAX.AND MIN. PLACE ADJUSTED XMIN. IN X(51).PLACE
    ADJUSTED DX ((XMAX - XMIN)/ 6.5) IN X (52).
COMPUTE SAME VALUES FOR Y. PLACE IN Y(51) AND Y(52).

THIS ROUTINE INSPECTS FIRST AND LAST POINT IN THE ARRAY. IF THE LAST
    POINT IS CLOSER IT REVERSES THE ORDER OF THE ARRAY TO TRY TO
    OPTIMIZE PLOTTER MOTION. IF THE FIFTH ARGUMENT IS NEGATIVE THIS
    ROUTINE PLOTS A SYMBOL AT ALTERNATE POINTS AS SPECIFIED BY MAGNI-
    TUDE OF FIFTH ARGUMENT. A POSITIVE FIFTH ARGUMENT CONNECTS ALL
    SYMBOLS AND INTERMEDIATE POINTS WITH A STRAIGHT LINE. THE SIXTH
    ARGUMENT SPECIFIES THE SYMBOL TO USE.

PLOT X AXIS STARTING AT(0.0,0.0) WITH THE TITLE HORIZ.,WITH THE ANNOTATION
    ON THE CLOCKWISE SIDE ,FOR AT LEAST 6.5 INCHES, AT 0.0 DEGREES,WITH
    THE NOTATION OF X(51) , X(51)+ X(52), X(51)+ 2* X(52) ,ETC.

PLOT A SIMILAR Y AXIS WITH TITLE VERTICAL ,ANNOTATION ON COUNTER-CLOCKWISE
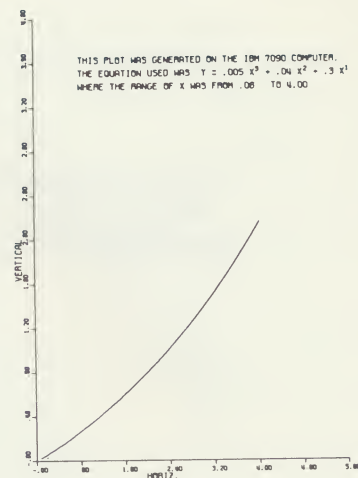    SIDE FOR 10.0 INCHES AT 90 DEGREES.

PLOT OUT DETAILS OF EQUATION AND DATA AT TOP OF GRAPH.
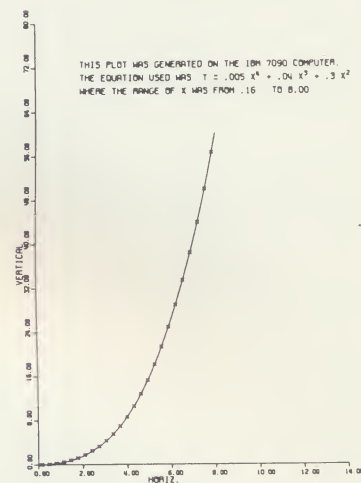
PLOT EXPONENTS OF EQUATION. SUPPRESS DECIMAL POINTS (-1).

ESTABLISH NEW REFERENCE POINT FOR NEXT GRAPH.

WRITE TERMINATING BLOCK ADDRESS OF 999 FOR PERIPHAL HANDLING OF PLOT TAPE.
EXIT FROM MACHINE.
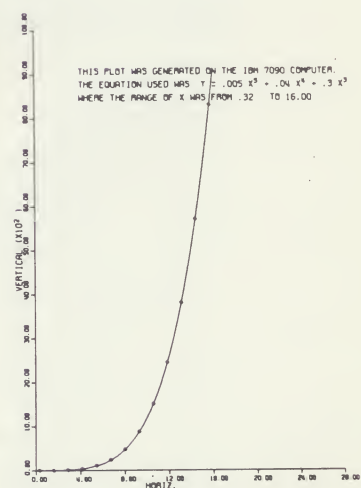
Plot 5

THIS PLOT WAS GENERATED ON THE IBM 7090 COMPUTER.
THE EQUATION USED WAS  Y = .005 X³ + .04 X² + .3 X¹
WHERE THE RANGE OF X WAS FROM .08  TO 4.00

Plot 6

THIS PLOT WAS GENERATED ON THE IBM 7090 COMPUTER.
THE EQUATION USED WAS  Y = .005 X⁵ + .04 X³ + .3 X²
WHERE THE RANGE OF X WAS FROM .16  TO 8.00

Plot 7

THIS PLOT WAS GENERATED ON THE IBM 7090 COMPUTER.
THE EQUATION USED WAS  Y = .005 X⁵ + .04 X⁴ + .3 X³
WHERE THE RANGE OF X WAS FROM .32  TO 16.00

# IV. FORTRAN CODING FORM

The Fortran Coding Form is included for your convenience to write routines applicable to your particular plotting problem.

| STATEMENT NO. | | | | | CONT. № | DO – NEST INDENT LEVEL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| "C" FOR COMMENTS | | | | | | 1 | | 2 | | 3 | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |

| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | PROGRAM IDENTITY NUMBER 73 74 75 76 | CARD NUMBER 77 78 79 80 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

# V. DIGITAL PLOTTING SYSTEMS

The equipment shown here is a representative cross-section of CalComp products. For more details, write for Bulletin 175 or contact your local Sales Representative.

## HIGH SPEED & VERSATILITY
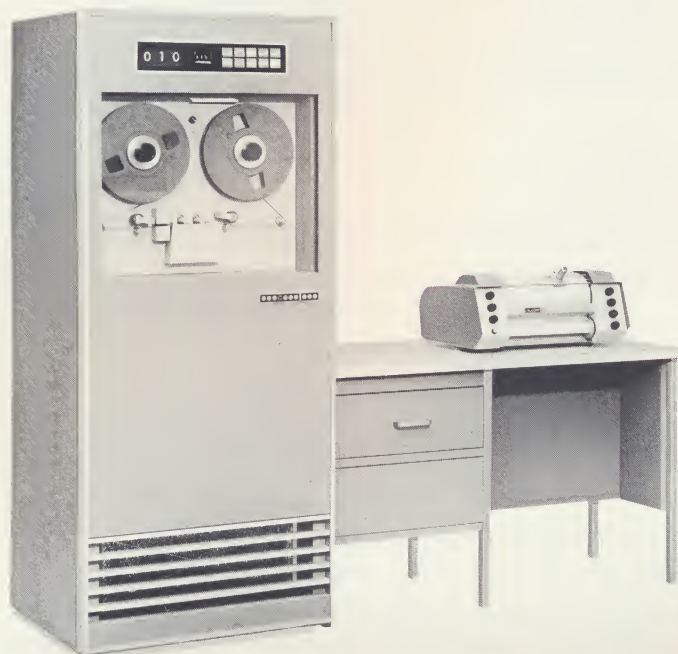
**CALCOMP MODEL 780
MAGNETIC TAPE PLOTTING SYSTEM
(Shown with CALCOMP Model 765
Digital Zip Mode® Plotter)**

For extra-high speed and fine resolution plotting, CALCOMP's 780 System provides reliable reading of standard computer tape at densities up to 800 bits-per-inch. The 780 Tape Unit is used with any CALCOMP 700 Series Digital Zip Mode Plotter, drum or flatbed type.

## LOW-COST

**CALCOMP MODEL 470 MAGNETIC TAPE PLOTTING SYSTEM
(Shown with CALCOMP Model 565 Digital Incremental Plotter)**

For a compact low-cost installation, using a CALCOMP Digital Incremental Plotter, the 470 System is fully contained in a desk-type table unit and operates with any 500 Series Digital Incremental Plotter.

# MAXIMUM SPEED & HIGH VOLUME



**CALCOMP MODEL 835 ELECTRONIC DIGITAL PLOTTING SYSTEM**

For high volume plotting applications, CALCOMP's Model 835 CRT/microfilm plotting system provides ultra high speed plotting and recording of computer output data, on-line or off-line. The Model 835 is fully incremental, and operates at rates up to 100,000 steps per second.

# MAXIMUM VISIBILITY DURING PLOTTING



**CALCOMP MODEL 502 FLATBED DIGITAL INCREMENTAL PLOTTER**

For full visibility of plot area at all times, CALCOMP's flatbed digital plotters are available in two sizes (31" x 34" and 48" x 72" plot areas), in both the 500 and 700 series.

# VI. PROGRAMMING SOURCE DECK SUMMARY

Please contact your local CalComp representative for current availability of routines for specific computers. (See preceding page.)

**LEGEND**

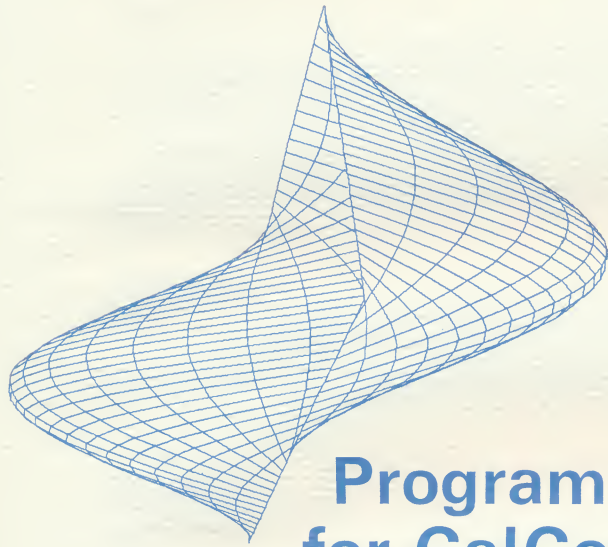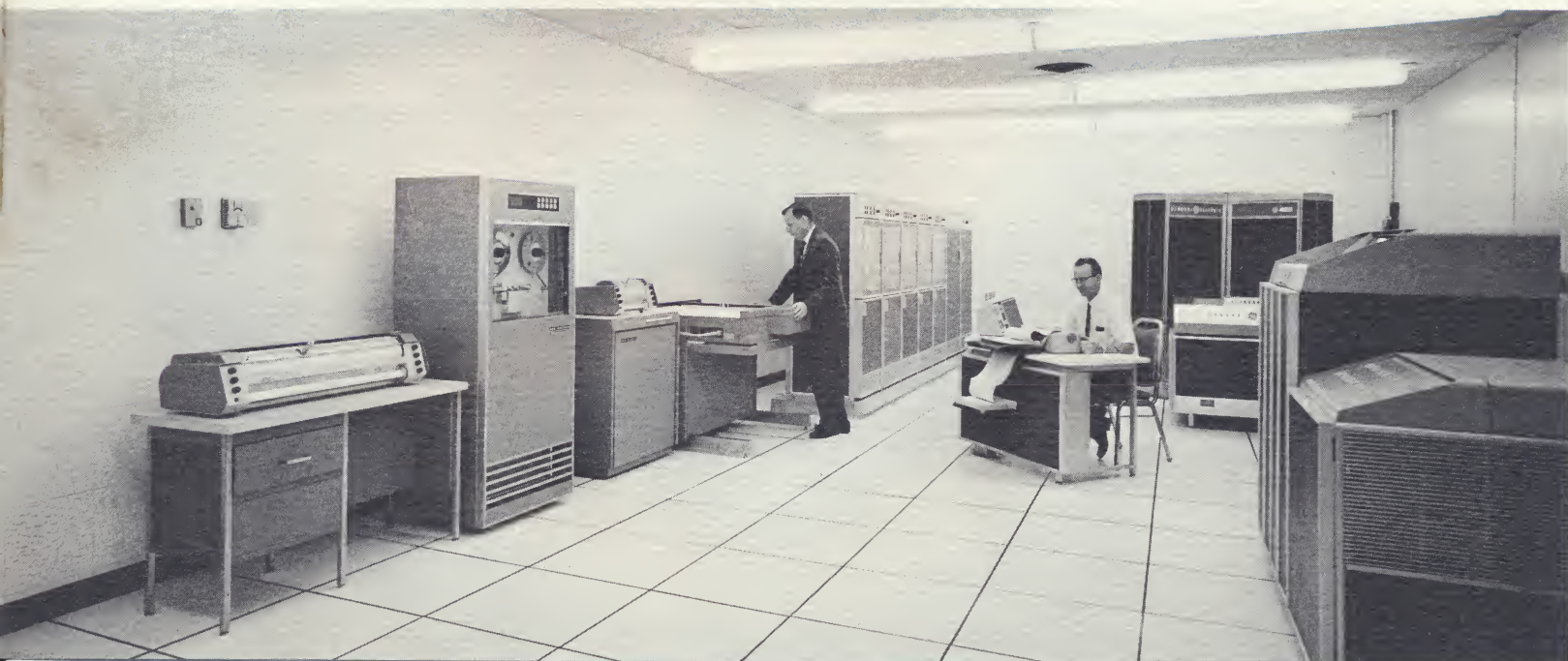☐ NOTHING CURRENTLY
☒ WRITTEN UNCHECKED
■ FULLY CHECKED

| COMPUTER | PLOT ON LINE | | PLOT 470/750 | | | PLOT 760 | | | PLOT 770/780 | | | SYMBOL | NUMBER | AXIS | LINE | SCALE | SAMPLE | 470 SIMULATOR | COMPILER | ASSEMBLER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 500 | 700 | 1/1 | 1/2 | 1/3 | 1/1 | 1/2 | 1/3 | 1/1 | 1/2 | 1/3 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
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CALCOMP

# Programming Services and Software for CalComp Digital Plotting Systems

# The CalComp *Plus* Factors

CalComp is the recognized leader of the digital plotting industry. Our product line of high-performance reliable digital plotting systems has become the quality standard for this new and rapidly expanding field. CalComp plotters are *versatile*—capable of generating high quality graphic output for many different applications—and *adaptable*—for on-line or off-line operation with almost any standard digital computer.

But excellence of equipment is only part of the story. There is an important *plus factor* which has played an essential role in establishing and maintaining CalComp leadership. That plus factor is the *system concept*. CalComp sells *digital plotting systems*—not just digital plotters. Like the computer with which it operates, a digital plotting system requires both hardware and *software* in order to perform any useful function.

Because of this system concept, CalComp is committed to a policy of continual development and improvement of plotter software. Our library contains many hundreds of computer programs, and the number increases each month. A full-scale computer facility has been installed in the CalComp plant, primarily for use in software development.

Our large staff of capable and experienced programmers is engaged in development of basic software for new CalComp systems and new computers, plus functional software for new plotter applications. CalComp also provides expert programming services—ranging from brief consultation to development of complete special-purpose computer programs.

Another *plus factor* when you buy or lease from CalComp is *freedom from obsolescence*. This applies to CalComp software as well as hardware. As your requirements increase, you may want to add another plotter to your system, or replace the original with a higher speed model. You may also want to upgrade your off-line tape unit to a more efficient model. In any case, CalComp can supply new software for your new system configuration. The same is true if you replace your original computer with another model, or install additional computers.

CalComp software—as an integral part of your CalComp digital plotting system—will help you utilize the versatility of CalComp equipment, and assure the most effective and efficient graphic output for your particular requirements.

## Catalog Basic Software

When you buy or lease a digital plotting system from CalComp, our programming staff furnishes a basic software package, tailored to your plotting system configuration and your particular computer system. At present, there are nearly 2000 basic plotting software packages in the CalComp library.

The basic software package consists of a set of plotter subroutines which can be integrated with your own computer programs. They are designed to prepare magnetic tapes for off-line plotting, or to drive an on-line CalComp plotter directly through a plotter controller. Basic software also provides the following functions:

1) Scaling the data to fit the plotting area

2) Drawing identification symbols at plotted data points

3) Drawing connecting lines between data points when desired

4) Drawing and labeling axes at any desired orientation

5) Selecting from a large number of characters, numbers, and special symbols, any of which can be drawn in any size and at any angular orientation anywhere on the plotting surface

The basic software also includes a routine called SAMPLE, designed for system test and training. It uses all of the basic plotting subroutines to produce a complete symbol table and a number of sample plots and graphs.

## Functional Software

CalComp's software library contains a number of functional plot routines which are available to users, and more are under development. These software packages are designed to provide maximum computer efficiency for frequently used plotting functions.

With these functional routines, you can automatically plot any of the following:

Arcs, spirals, and circles of any size

Centerlines (long and short dashes) midway between specified data points

Any of several types of arrows, in any position at any angular orientation

Ellipses or rectangles, any size and at any angle

Dimension lines, complete with arrowheads and annotation

Grids with any desired spacing and placement

Curves where Y is a function of X, or X is a function of Y

Fitted semi-hyperbolic curve between any three data points

Like CalComp's catalog basic software, the functional routines are available for most standard digital computers, and can be used for either on-line or off-line plotting with all CalComp systems.

## Programming Services

The availability of a wide range of programming services, tailored to your specific requirements, is another CalComp *plus factor*. Our staff of expert, experienced programmers can help adapt catalog software to your computer programs and your particular computer system, maximize the effectiveness of your graphic output, maximize computer efficiency, and minimize the programming skills required for operation of your digital plotting system. Available services include consultations with your own programming staff, programmer training courses, installation and checkout of plotter software, and the development of complete computer programs for digital plotting applications.

Here are just a few of the widely diversified plotting applications where CalComp's programming staff has participated and assisted in developing special software:

Graphic management reports for public utilities

Highway cross sections and topographic maps for state highway departments

Military mapping applications

Contour maps and seismic data plotting for petroleum exploration studies

Land use studies and transportation studies for regional planning commissions

Perspective drawings for architectural and engineering applications

Real-time plotting applications, including remote systems

## Software Costs

For most CalComp digital plotting systems, the purchase or lease price also covers use of the original catalog basic software supplied with the system. This applies to all off-line systems, all Zip Mode and flatbed plotters, and the Model 835 Electronic Digital Plotter. With the lower cost digital plotters and on-line systems, a small additional charge is made for use of the catalog basic software — primarily to cover handling costs. A similar charge is made for replacement of your original basic software with a different package, and a nominal fee is charged for use of the CalComp functional software packages. Programmer consulting services are billed at an hourly rate, or under negotiated terms.

In summary, these are the *plus factors* which typify CalComp leadership in the digital plotting field:

A quality line of digital plotting systems—including both hardware and software

Catalog basic software for all CalComp systems and most digital computers

Freedom from obsolescence—in both hardware and software

Functional software for maximum computer efficiency

A capable, experienced programming staff offering a broad range of consulting services

FOR DETAILED INFORMATION ABOUT
CALCOMP SOFTWARE CONTACT YOUR
LOCAL SALES REPRESENTATIVE
OR CALCOMP MARKETING

CALCOMP

# SCOPLT

This CalComp software package makes it possible for System/360 users to make permanent hard copy, on demand, from displays presented on the scope of the IBM 2250, Model I. OS/360 SCOPLT (scope plot) can be used on-line or off-line with any CalComp Digital Graphic System, including the Electronic/Microfilm system Model 835.

# SCOPLT ROUTINE

## INTRODUCTION

Users of the IBM 2250, Model 1, graphic display device ("scope") will find it very desirable to obtain a hard copy of the screen image upon demand. The OS/360 SCOPLT (scope-plot) routine provides this capability when used with either on-line or off-line CalComp plotting systems, including the Model 835. Upon request, a modified version can be provided to accommodate users of the IBM 2250 with no buffer, or with a 16K buffer for multiple scopes.

Application programs for the IBM 2250 are usually written in FORTRAN language, with the aid of a special graphics subroutine library called GPAK (developed jointly by IBM and the Share User's Group). The GPAK subroutines are called by the FORTRAN program to create a sequence of graphic orders and to "write" these into the scope buffer. The buffer orders then produce the image on the screen, independently of the main computer.

## PROCEDURE

The scope user can communicate with the application program via the Function Keyboard at the scope console. This keyboard contains 32 unmarked keys. Each key's function is determined arbitrarily by the particular application program. Depressing a key causes an internal interrupt and the program performs the respective function.

In this manner one of the function keys can be assigned for the purpose of requesting a plot of the screen image. When the key is pressed, the application program calls the SCOPLT routine which then reads the IBM 2250 buffer into core storage, translates the graphic orders into equivalent plot commands, and returns to the calling program with an error code.

## PLOT GENERATION

The IBM 2250 screen is about 12" square and contains 4096 x 4096 raster units (r.u.). However, coordinate values must be a multiple of four when actually used in a graphic order, so the net resolution is 1024 x 1024. SCOPLT scales the X,Y screen coordinates to page coordinates which results in a 10.24" x 10.24" plot with the same accuracy as the screen-image, and 400 r.u. per inch resolution. The Beam bit (blank/unblank) is recoded to the appropriate plotter pen status code (up or down). The PLOT and SYMBOL routines are called to generate the required plotter commands. (Note: The revised standard SYMBOL routine should be available to assure proper scaling of characters.)

The plot is drawn with "corner lines" to indicate the boundaries. Coordinates that exceed the maximum are indicated by drawing a box symbol just outside the boundary. "Null" characters are considered spaces. Character strings that run outside the plot are not truncated, nor do they "wrap-around" unless a "new-line" character is detected.

PLOT GENERATION (Continued)

Only the Basic graphic character size is currently supported, re-
sulting in a 0.14" character height with 74 characters per line
border-to-border.  Screen "points" are drawn as plus (+) symbols to
assure ink flow from the pen.

USE

This routine may be assembled and linked into the installation's O.S.
program library, preferably the same one that contains PLOT and
SYMBOL.  It may be invoked by any FORTRAN or Assembly language program
that requires this function.

The application program must call PLOTS before calling SCOPLT in
order to open the plot tape and initialize the PLOT subroutine with
the buffer address and size.  Since SCOPLT may be invoked several
times, it does not write a "999" block address at the end of each
plot.  This should be done by the calling program when the scope user
is finished.  Since GPAK allows partitioning of the scope buffer
into "areas," each of which may be loaded separately, the SCOPLT
routine also permits any number of these buffer areas to be plotted.
This is specified in the calling sequence by defining the first and
last positions (0-8191) of each buffer area.

CALLING SEQUENCE

        CALL SCOPLT, (IERROR,IF1,IL1,IF2,IL2,---IFn,ILn)

where,   IERROR            is the location where SCOPLT can store the
                           error code.

         IF1,IL1,---       are optional parameters defining the relative
         IFn,ILn           address of the first and last buffer
                           positions of each area to be interpreted.  If
                           these parameters are omitted, positions 100
                           and 8191 are assumed.  In all cases, the "first"
                           position must be an even address.

A //PLOTTAPE DD card must be supplied, defining the data set which
will contain the PLOT output records.  This is the same as that
required when PLOT is used directly.

STORAGE REQUIREMENTS

The following elements determine the storage used during execution of
this routine:

        SCOPLT module          = 2K
        Graphic Buffer area    = 8K
        PLOT module            = 2K
        SYMBOL module          = 2K   (not including SIN/COS)

        Total                  14K   plus the PLTBUF area

ERROR CODES

Since this routine may be used while debugging other "scope" pro-
grams, several diagnostic checks are included.  The various error
conditions are indicated by the following codes:

    0 = satisfactory completion.
    1 = first byte of an order is not X'2A'.
    2 = first byte of an order is at odd address within
        buffer area.
    3 = address of next order is outside buffer range.
    4 = invalid order.
    5 = character string exceeds 255 bytes, without a
        "new-line" character.
    6 = graphic order program attempted to repeat an order
        (recursion).

EXAMPLE

The following partial example assumes that an image is being gener-
ated on the screen from buffer area 1.  When Function Key 0 is
pressed, the application program displays the message **PLOTTING**
in an unused section of the screen, from buffer area 0, and calls
SCOPLT.

```
      DIMENSION PLTMSG(3)
  100 FORMAT(3A4)
      READ(n,100) PLTMSG
      CALL PLOTS (BUFFER,BUFSIZ,0)
C SETUP IMAGE IN AREA 1 USING GPAK SUBROUTINES.
      ---
  200 CALL GWAIT
C PROGRAM WAITS UNTIL FUNCTION KEY IS PRESSED.
C THEN 'PLOTTING' MESSAGE IS DISPLAYED AND 'SCOPLT' IS CALLED.
      CALL STAREA (0,1)
      CALL MSGBLD (0,MSGX,MSGY,PLTMSG,20,IBFLOC)
      CALL DISPLAY (0,0)
      CALL SCOPLT (IERROR,204,8188)
C ONLY BUFFER AREA 1 IS PLOTTED IN THIS EXAMPLE.
C FURTHER PROGRAMMING MAY ALTER SCREEN IMAGE.
C AND RETURN TO STATEMENT 200.
C AT END OF JOB, THE PLOT TAPE SHOULD BE CLOSED.
      CALL PLOT (0,0,999)
```

2/27/67
WJC:pbh

# THREE-D SOFTWARE

CalComp's THREE-D software package enables users to generate
perspective views of a function of two variables.  The surface
can be considered to be either translucent or opaque.  For the
translucent surface, all lines are drawn, but for opaque views,
hidden lines can be deleted at the user's option.  THREE-D can
be used with any CalComp Digital Graphic System, either on-line
or off-line.  The Model 835 Electronic/Microfilm System is
especially effective for the creation of movies and stereoscopic
pairs. THREE-D is an all FORTRAN package.

## USE

The basic input to THREE-D is a rectangular grid of points (i.e., a grid where the points along the ordinate and the abscissa are spaced at a constant interval). However, routines are available to grid irregular data. The preparation of the grid and the setting up of some basic control parameters is phase 1 of the execution.

Once phase 1 has been completed, phase 2, the plotting phase, is entered. In this section the user must specify only the observation points of the surface.
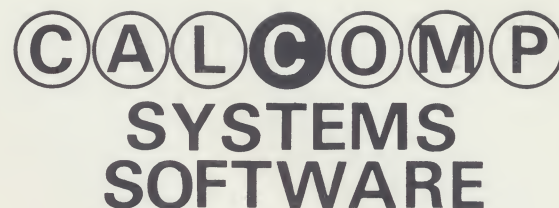

## STORAGE REQUIREMENTS

Utilizing a GE 425 computer

|  |  |  |
|---|---|---|
| THREE-D module | = | 3K words |
| PLOT and SYMBOL module | = | 3K words |
| | | ——— |
| TOTAL | | 6K words |


Pricing information available on request.

# CALCOMP
## SYSTEMS
## SOFTWARE

# THREE-D SOFTWARE

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# CALCOMP

# THREE-D PERSPECTIVE PLOTTING PACKAGE

## INTRODUCTION

The accepted proverb, "A picture is worth a thousand words", is the basic motive behind the plotting of numerical data. Functions of one variable are easily depicted because of the two dimensions available in the plotting medium; but to represent a function of two variables, one must either have a three-dimensional display medium or strive for a perspective representation of the function in two dimensions. It is the latter form of display that is used by the THREE-D package. The qualitative nature of perspective representation gives a far better intuitive feel for the problem at hand than a collection of numbers. For example, the user can "look" at the population density of a geographical region and correlate it with a perspective view of the density of purchase for a certain product. The engineer can see the rate at which heat distributes in an irregular object. The areas of application are limited only by the user's imagination.

## PROCEDURE

The THREE-D package depicts a surface by drawing the projection of constant abscissa and ordinate lines in the perspective plane. If the user considers the surface translucent, all lines are projected and drawn regardless of their relation to other portions of the surface.

If the surface is defined to be opaque, the lines passing through the hidden sides of the surface are not drawn. The areas near the "visible edge" of the surface produce converging lines in the projective plane, giving the picture a unique kind of shading in these regions.

The package also has the capability to produce stereoscopic pairs automatically and the feature of drawing space curves is inherent.

A square is plotted around the surface so that when the figure is viewed from different angles, the views can be referenced to this square.

USE

The basic input to THREE-D is a rectangular grid of points (i.e.,
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STORAGE REQUIREMENTS

Utilizing a GE 425 computer

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## STORAGE REQUIREMENTS

Utilizing a GE 425 computer

|                          |   |          |
|--------------------------|---|----------|
| THREE-D module           | = | 3K words |
| PLOT and SYMBOL module   | = | 3K words |
|                          |   |          |
| TOTAL                    |   | 6K words |


Pricing information available on request.

# SOFTWARE
# SYSTEMS
## FOR DIGITAL GRAPHICS

CC

*780*

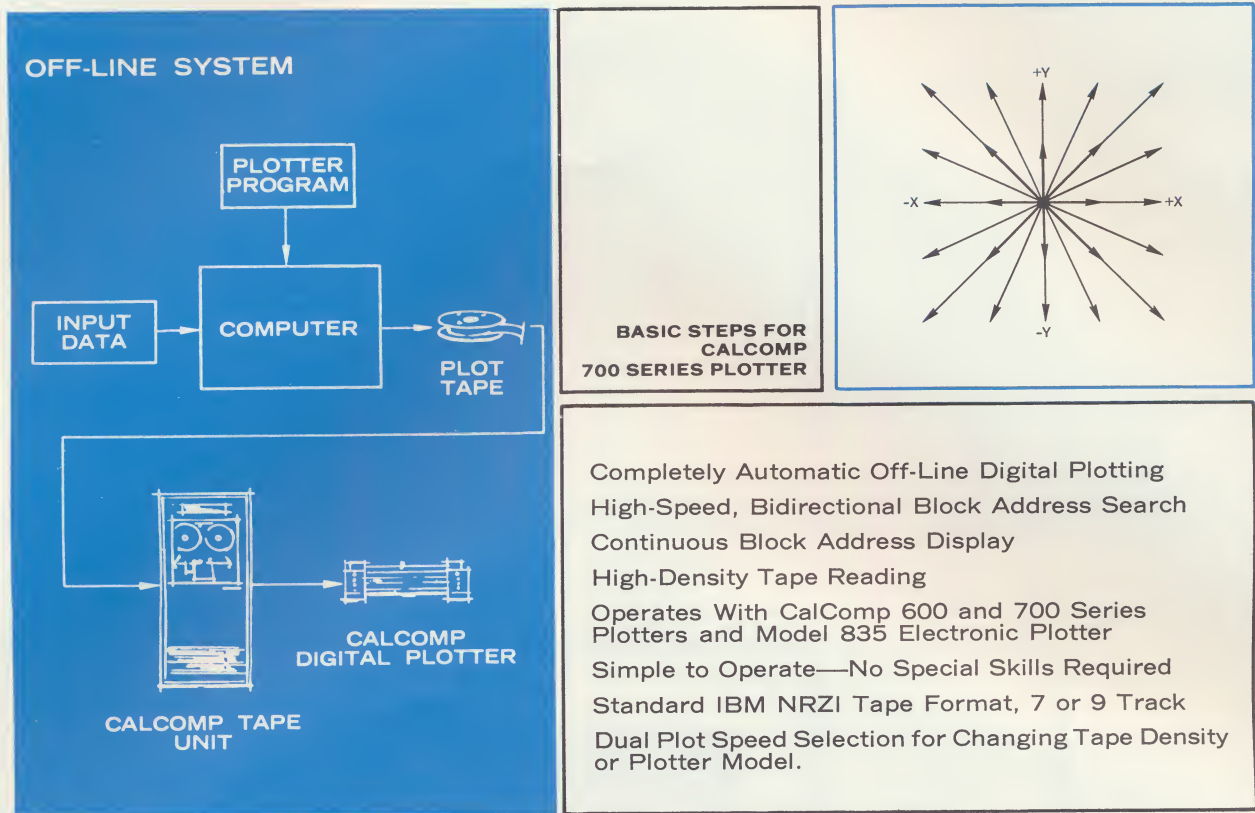# MODEL 780 MAGNETIC TAPE PLOTTING SYSTEM

C A L C O M P

CALCOMP MODEL 780
WITH MODEL 765 PLOTTER

The CalComp Model 780 is a magnetic tape unit for versatile, completely automatic, high-speed digital plotting, one of four magnetic tape units in the 700 series. Designed for off-line operation with virtually any medium or large-scale digital computer, the Model 780 is compatible with all CalComp Digital Incremental 600 Series Plotters and Digital Zip Mode® 700 Series Plotters, and with the new Model 835 Electronic Digital Plotter. The precision-engineered tape transport and logic circuitry provide all the advantages of off-line digital plotting and include a number of special features for maximum plotting flexibility.

**OFF-LINE SYSTEM**

PLOTTER PROGRAM

INPUT DATA → COMPUTER → PLOT TAPE

CALCOMP TAPE UNIT → CALCOMP DIGITAL PLOTTER

**BASIC STEPS FOR CALCOMP 700 SERIES PLOTTER**

Completely Automatic Off-Line Digital Plotting

High-Speed, Bidirectional Block Address Search

Continuous Block Address Display

High-Density Tape Reading

Operates With CalComp 600 and 700 Series Plotters and Model 835 Electronic Plotter

Simple to Operate—No Special Skills Required

Standard IBM NRZI Tape Format, 7 or 9 Track

Dual Plot Speed Selection for Changing Tape Density or Plotter Model.

## SYSTEM OPERATION

The Model 780 Magnetic Tape Plotting Unit utilizes seven tracks of a standard IBM-format 7 or 9 track ½-tape to provide automatic search and recognition of pre-selected block address codes, and to supply input commands to a CalComp Digital Plotter. The system is capable of operating at tape densities of 200, 556 or 800 bits-per-inch. A dual tape selector switch, a special feature of Model 780, offers a choice of options of tape densities or plotter speeds.

When using 7-track tape, there is a choice of:

1) Dual Tape Density (full or half density) and Single Plotter Speed; or

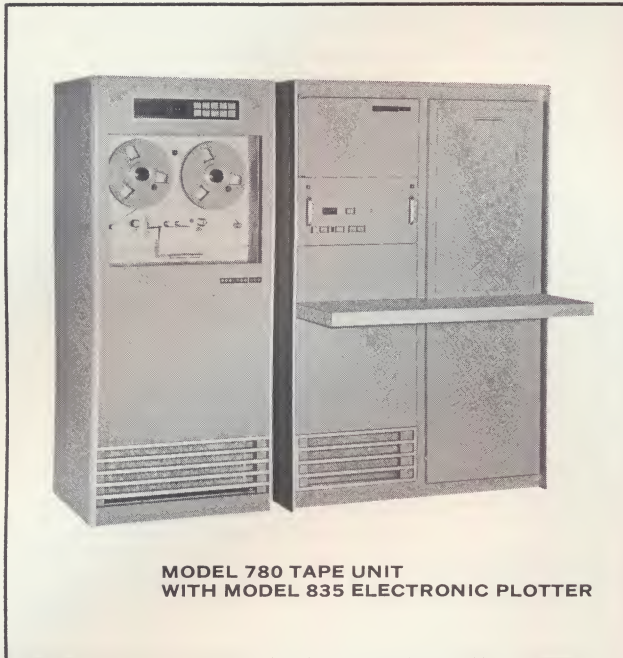2) Single Tape Density and Dual Plotter Speed.

If the latter option is used, the Model 780 can drive either of two different plotters, even though their incremental speed rates may differ. With 9-track tape, the dual speed selector permits the use of either of two plotters as with 7-track tape, but the unit operates only at 800 bpi, half density. Model 780 has the capability for reading either 556 bpi tapes at full density or 800 bpi tapes at half density. The unit operates with Model 835 Electronic Digital Plotter as well as both the 600 and 700 series Digital Plotters.

The 600 and 700 series plotters for which the unit is designed provide for higher speed incremental operation compared to the 500 series, plus the exclusive Zip Mode® feature of the 700 series which provides for plotting of smooth curves and straight lines at nearly four times the incremental speed.

Zip Mode plotting also provides a saving in magnetic tape. Another feature of the 600 and 700 series plotters is the provision for either full-step or half-step operation, or any intermix of the two in the X and Y axes, to provide a total of 24 basic plot steps, as shown in the accompanying diagram. A single-character code is used for each plot command for the various control commands.

The Model 780 and all tape units in the CalComp 700 series include a number of special features for ease of tape handling and plotting flexibility. The block address of the data to be plotted is preset by means of a three-digit thumbwheel switch. Either forward or reverse search mode may be used, and the transport automatically changes direction after the first block address is read from the tape if the tape is traveling in the wrong direction. The tape speed during search mode is 60 inches-per-second. The transport stops and a PLOT READY indicator lights when the selected block address has been found. Either single or multiple plot mode may then be selected. For multiple plot mode, the thumbwheel switch is reset to the block address following the last data to be plotted. The unit then automatically plots all data in sequence until that block address is read from the tape. Other features include a tape lifter which holds the tape clear of the read head during fast forward and rewind operations and during tape loading. Magnetic-particle brakes on the reel motors provide fast starting and stopping and eliminate mechanical wear. The transport uses standard 10½ inch tape reels.

**MODEL 780 TAPE UNIT
WITH MODEL 835 ELECTRONIC PLOTTER**



**MODEL 765
DIGITAL ZIP MODE® PLOTTER**

## PLOTTER OPTIONS

All 600 and 700 series CalComp plotters are compatible with the Magnetic Tape Plotting Unit described in this Bulletin. The Model 835 Electronic Digital Plotter is also compatible with the unit.

## 600 SERIES

The CalComp 600 series includes two drum types — the Model 665 with a plotting area of 11 inches (Y-axis) by 120 feet (X-axis); and Model 663 with a plotting area of 29½ inches by 120 feet. Both are compatible with the 700 series and operate in either full-step or half-step mode, with a maximum incremental rate of 900 steps-per-second. (See Bulletins No. 209, 210.)

## 700 SERIES

The 700 series includes two drum types and two flatbed types. The drum plotters are Model 765 (plotting area of 11 inches by 120 feet) and 763 (plotting area of 29½ inches by 120 feet). Maximum incremental speed is 450 steps-per-second. In the Zip Mode, the speed is 3.75 times the maximum incremental rate, or 1687 steps/second. The 700 series

also features the "electronic gear-shift" which permits either full-step or half-step operation, or a combination of the two, for improved resolution. (See Bulletins No. 196, 197.)
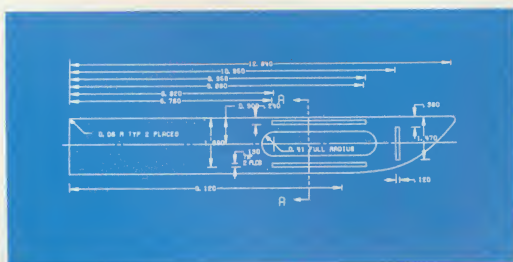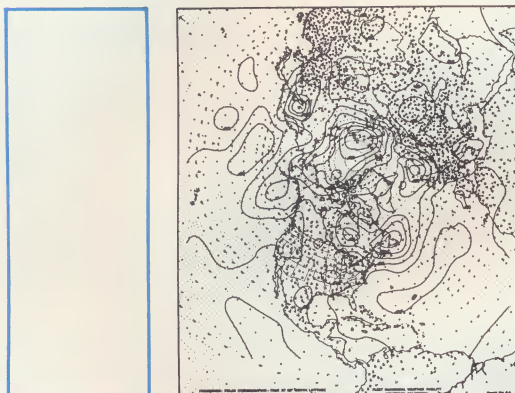
Two flatbed types are available in the 700 series. The Model 702 has a plotting area of 31 by 34 inches, and an incremental rate of 450 steps-per-second. A choice of four incremental step sizes is available. The Model 718 has a plotting area of 54 by 72 inches with maximum incremental step rate of 450 steps-per-second and maximum Zip Mode speed of 1687 steps-per-second. (See Bulletins No. 200, 201.)

## 800 SERIES

The CalComp Model 835 is an ultra-high-speed, all electronic digital incremental plotter which provides automatic recording of a cathode ray tube plot display on 35mm microfilm. When used with a 700 Series Magnetic Tape Plotting Unit, the Model 835 is capable of plotting all data on a 2400-foot reel of tape in 8 minutes. Maximum plotting speed, with 556 bpi tape, is 33,000 steps-per-second. Plot area, with optimum 15x magnification of microfilm image, is 11 by 17 inches. The Model 835 step size (when magnified 15x) is .005 inches. (See Bulletin No. 188.)

# SPECIFICATIONS

|  | Model 470 | Model 750 | Model 760 | Model 770 | Model 780 |
|---|---|---|---|---|---|
| Operates with CalComp Digital Plotter series | 500 | 500, 600 | 500, 600, 835 | 600, 700, 835 | 600, 700, 835 |
| Plot commands per inch of tape at 200 bpi | 67 | 67 | 200 | 200 | 200 |
| 556 bpi | 93 | 93 | 278 | 278 | 556 |
| 800 bpi | 89 | 89 | 267 | 267 | 400 |
| Maximum inches of plot per inch of tape | 1.3 | 1.3 | 3.9 | 14.7 | 29.4 |
| Block address display and automatic search | No | Yes | Yes | Yes | Yes |
| Search speed (in/sec) | 4½ | 60 | 60 | 60 | 60 |
| Tape reel size (max. in.) | 8½ | 10½ | 10½ | 10½ | 10½ |
| Tape lifter for fast forward and rewind | No | Yes | Yes | Yes | Yes |
| Tape speed control switch for change of tape density or plotter model | No | Yes | Yes | Yes | Yes |
| Max. power requirement (watts) | 500 | 800 | 800 | 1400 | 1400 |





## APPLICATIONS

The applications for CalComp digital plotting systems are as numerous and varied as the applications for the computers they complement. In every branch of government, in every scientific field, in industry and business, CalComp digital plotters and plotting systems have proved their accuracy, reliability, and efficiency. *Any* computer output data that can be reduced to graphic form manually can be automatically plotted on CalComp equipment—faster, with greater precision, and usually at lower cost.

## SOFTWARE SUPPORT

CalComp's staff of skilled programmers has one basic assignment: to provide our customers with the most comprehensive software support possible. This has always been a CalComp policy, because we know that it is good business—and that in the computer world, quality software is just as important as quality hardware. One important result of this policy: CalComp customers are able to put their plotting system to work as soon as it is delivered. And, equally important, they find that digital plotting is an easy task.

CALIFORNIA COMPUTER PRODUCTS, INC.
305 North Muller Street    Anaheim, California 92803
Phone (714) 774-9141    TWX 910-591-1154

563

# MODEL 563 DIGITAL INCREMENTAL PLOTTER DRUM TYPE

C A L C O M P

The CalComp Model 563 is one of several models in the 500 series, suitable for automatic digital plotting with virtually any standard computer—on-line or off-line. The unit is simple to operate, and has a large effective plotting area—29½ inches by 120 feet. Either ballpoint or liquid ink pens may be used for production of high quality ink-on-paper plots of computer output data, with unvarying accuracy.
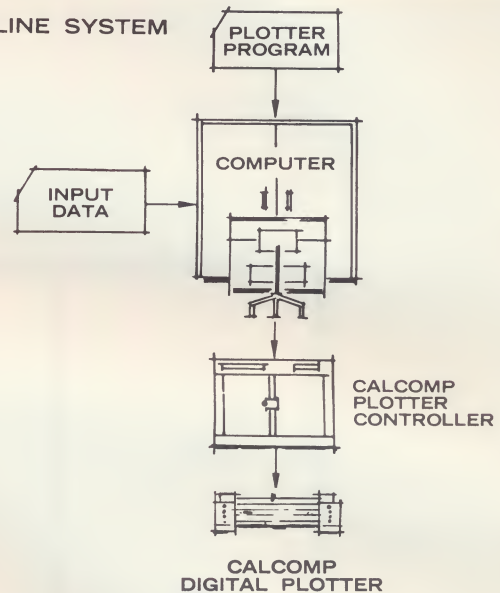
BASIC STEPS
500 SERIES INPUT



OFF-LINE SYSTEM

ON-LINE SYSTEM

## PRINCIPLES OF OPERATION

All CalComp 500 series Digital Incremental Plotters operate on the same basic principle. Bidirectional step motors are used for the X and Y axes and the plot is produced by movement of a pen relative to the surface of the recording paper. Each input command produces one incremental step in the X or Y axis, or a combined X and Y movement, in either the positive or negative direction. (See diagram.) Additional commands are used to raise or lower the recording pen. In the drum type plotters (Model 563 and 565), a Y-axis command causes the pen carriage to move one step to the left or right, and an X-axis command causes the drum to move one step upward or downward. The incremental step size is determined by the gearing in the plotter, and several options are available. The incremental rate is either 200 or 300 steps-per-second, depending on the
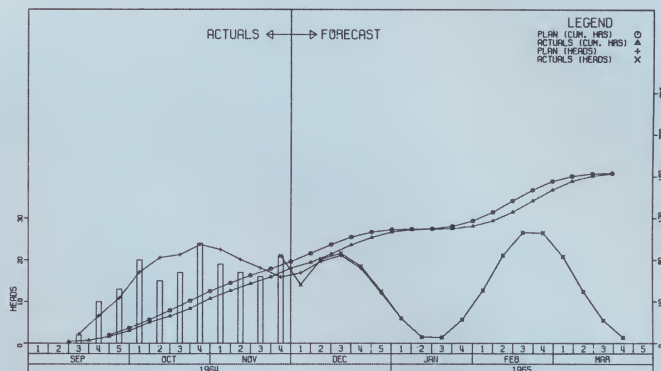
model and step size. Manual controls are provided on the plotter for positioning the drum and pen carriage, and for raising and lowering the pen.

When the digital plotter is used in an off-line system, the plot data and associated control commands are pre-recorded on magnetic tape. The tape is then played back on a CalComp magnetic tape unit. The tape unit includes control logic circuits which locate the plot data on the tape, and decoding circuits which supply the X and Y axis drive signals to the plotter, and the pen-up or pen-down (Z-axis) commands.
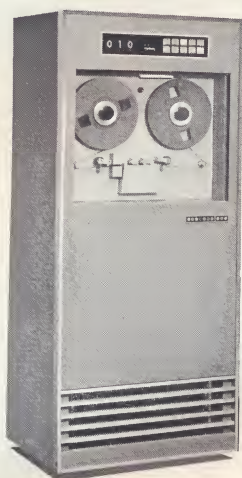
When the plotter is used in an on-line system, the plot data and control commands are supplied directly to the plotter through a CalComp Plotter Controller or adapter, or through interface electronics supplied by the computer manufacturer.

**Manloading chart for a major development program**—one of hundreds of applications for CalComp digital incremental plotters.

**OFF-LINE TAPE UNIT**



**ON-LINE PLOTTER CONTROLLER**



## OFF-LINE OPTIONS

The CalComp product line includes three Magnetic Tape Plotting systems for off-line digital plotting with the 500 series Digital Incremental Plotters.

### Model 470
Provides a compact off-line system at minimum cost. (See Bulletin No. 189.)

### Model 750
Provides special features for greater ease of tape handling and plotting flexibility. (See Bulletin No. 190.)

### Model 760
Includes special features of Model 750, plus a tape format which reduces significantly the computer time and the amount of tape required for plotting. (See Bulletin No. 191.)

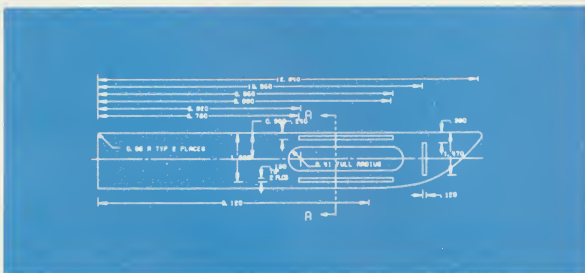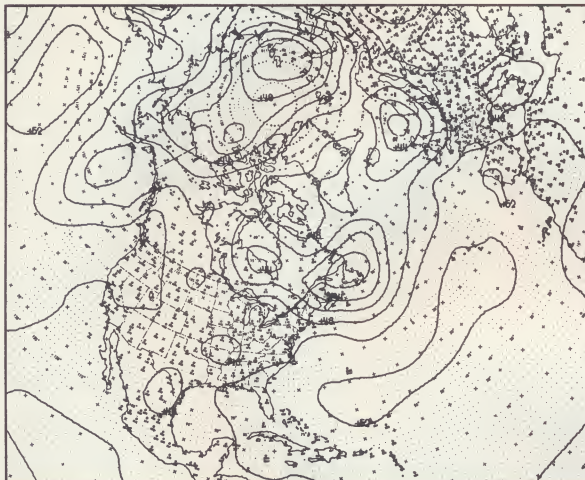### Model 471
### Automatic Tracer/Digitizer

Precisely follows continuous graphic data — curves, profiles, outlines — and converts this analog data to digital increments and records it on magnetic tape. (See Bulletin No. 176.)

## ON-LINE OPTIONS

CalComp offers a wide range of interface equipment for on-line digital plotting with 500 series plotters and most standard digital computers. These include the Model 100 Plotter Buffer (Bulletin No. 138), a series of Plotter Controllers with optional core buffer, and several Plotter Adapters. For detailed information, contact "CalComp Marketing" or your local Sales Representative.

# SPECIFICATIONS

| | | Model 565 | Model 563 | Model 502 | Model 518 |
|---|---|---|---|---|---|
| Type | | Drum | Drum | Flatbed | Flatbed |
| Maximum plot size: Y-axis<br>X-axis | | 11"<br>120' | 29½"<br>120' | 31"<br>34" | 54"<br>72" |
| Incremental step size options | (1)<br>(2)<br>(3)<br>(4)<br>(5) | .010"<br>.005"<br>0.1 mm<br>—<br> | .010"<br>.005"<br>0.1 mm<br>—<br> | .010"<br>.005"<br>.002"<br>0.1 mm<br>0.05 mm | .005"<br>.002"<br>0.1 mm<br>—<br>0.05 mm |
| Max. incremental speed (vs. step size) in steps/second | (1)<br>(2)<br>(3)<br>(4)<br>(5) | 300<br>300<br>300<br>—<br> | 200<br>300<br>300<br>—<br> | 300<br>300<br>300<br>300<br>300 | 200<br>450<br>200<br>—<br>400 |
| Inputs (Models 565 and 563 only; for Flatbeds, see Bulletins 198, 199) | | Positive or negative polarity pulses, amplitude greater than 10V, rise time less than 10 $\mu$sec, minimum pulse width 4 $\mu$sec, source impedance less than 500 ohms | | | |
| Power requirements | | 105 to 125 vac, single phase, 50/60 Hz, 1.5 amp. at 115 vac | | | |





## APPLICATIONS

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# MODEL 763 DIGITAL ZIP MODE ® PLOTTER
## DRUM TYPE



**C A L C O M P**

The CalComp Model 763 is one of several models available in the Zip Mode® 700 series. The unit is suitable for automatic, high-speed digital plotting with virtually all standard computers, on-line or off-line. The exclusive CalComp Zip Mode, a feature of all 700 series plotters, provides very high-speed plotting of smooth curves and straight lines, plus a significant reduction in computer time and magnetic tape. The "electronic gear shift," another CalComp exclusive, provides full-step/half-step intermix for improved accuracy and resolution. Either ballpoint or liquid ink pens may be used for production of high quality ink-on-paper plots of computer output data, with unvarying accuracy.

Completely digital, high-speed, high-resolution plotting
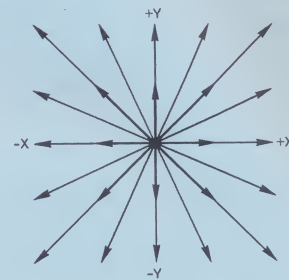
On-line or off-line, fully automatic operation

Incremental speeds up to 450 steps/second, Zip Mode speed up to 1687 steps/second (depending on step size)

Full-step/half-step "electronic gear shift" for better accuracy and resolution
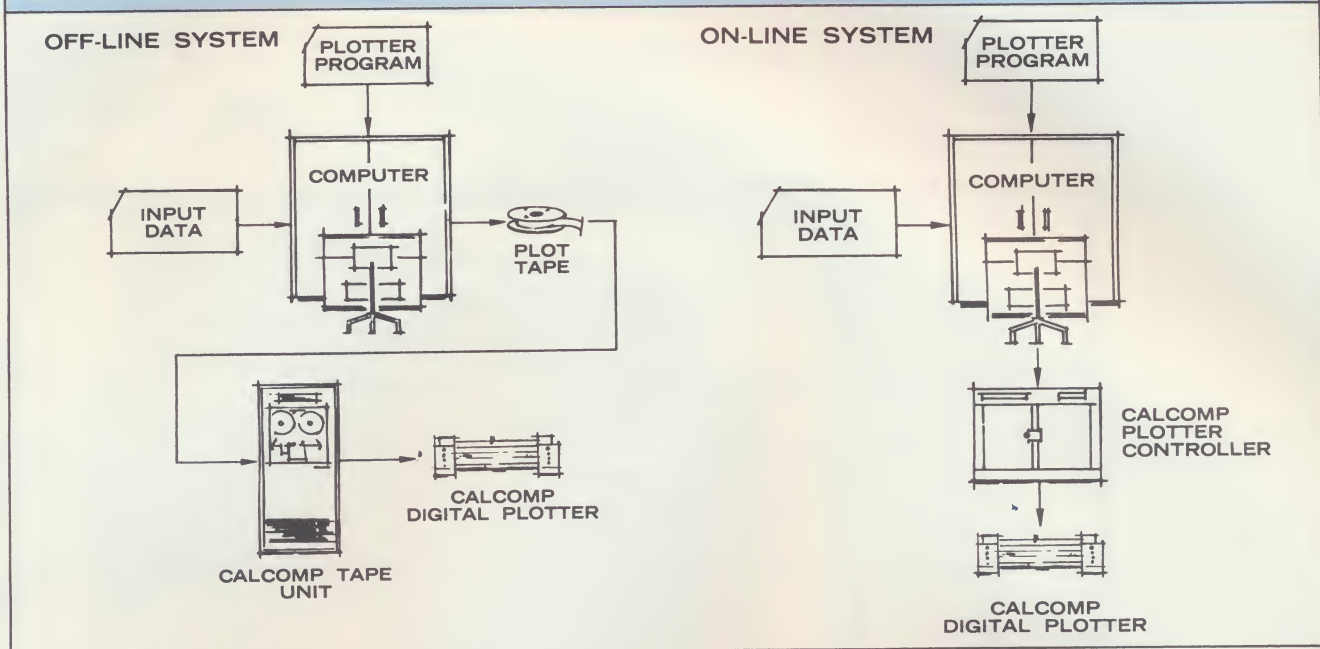
Optional step sizes

No paper alignment required

Wide paper selection, plain or preprinted rolls



**BASIC STEPS
700 SERIES INPUT**

OFF-LINE SYSTEM



ON-LINE SYSTEM



## PRINCIPLES OF OPERATION

All CalComp 700 series Digital Zip Mode® Plotters operate on the same basic principle. Bidirectional step motors are used for the X and Y axes and the plot is produced by movement of a pen relative to the surface of the recording paper. Coded input commands select either incremental or Zip Mode operation. In the incremental mode, each input plot command produces one incremental step in the X or Y axis, or a combined X and Y movement, in either the positive or negative direction. In addition, the command codes provide for either full-step or half-step increments, or any X and Y axis full-step/half-step intermix. These combinations provide a total of 24 basic plot steps, as shown in the diagram. Additional command codes are used to raise or lower the recording pen. In the Zip Mode, each input plot
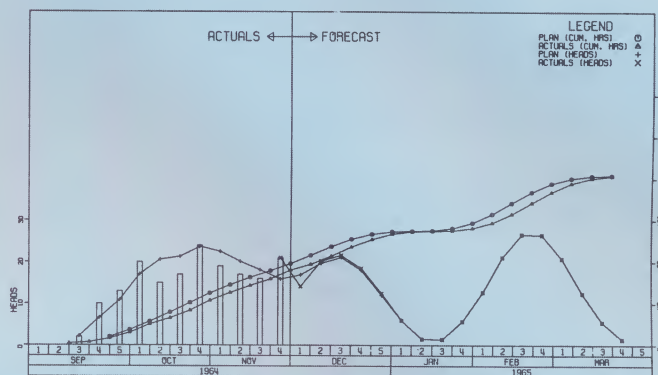
command represents a velocity increment and causes an increase or decrease in speed relative to either axis, or both axes. Maximum speed in the Zip Mode is 3.75 times the maximum incremental speed.

In the drum type plotters (Model 765 and 763), Y-axis commands cause the pen carriage to move left or right and X-axis commands cause the drum to move upward or downward. The incremental step size is determined by the gearing in the plotter, and several options are available. Maximum incremental and Zip Mode rates are dependent on the model and step size. Manual controls are provided on the plotter for positioning the drum and pen carriage, and for raising and lowering the pen.
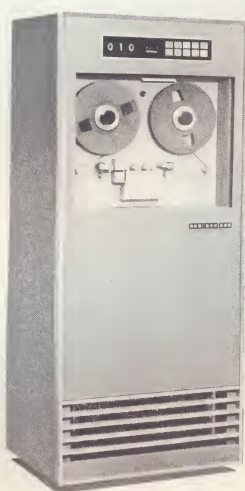
When the digital plotter is used in an off-line system,

**Manloading chart for a major development program**—one of hundreds of applications for CalComp digital incremental plotters.

**OFF-LINE TAPE UNIT**



**ON-LINE PLOTTER CONTROLLER**



the plot data and associated control commands are pre-recorded on magnetic tape. The tape is then played back on a CalComp magnetic tape unit. The tape unit includes control logic circuits which locate the plot data on the tape, and supply the X and Y axis drive signals, mode selection signals, and the pen-up or pen-down (Z-axis) commands to the plotter.

When the plotter is used in an on-line system, the plot data and control commands are supplied directly to the plotter through a CalComp Plotter Controller.

## ON-LINE OPTIONS

CalComp also offers a selection of Plotter Controllers for on-line digital plotting with the 700 series plotters.

These units include a number of operator convenience features and options for increased computer efficiency and plotting flexibility. For detailed information, contact "CalComp Marketing" or your local Sales Representative.

## OFF-LINE OPTIONS

The CalComp product line includes two Magnetic Tape Plotting systems for off-line digital plotting with the 700 series Digital Zip Mode plotters. The *Model 770* system incorporates a number of special features for ease of tape handling and plotting flexibility. (See Bulletin No. 192.) The *Model 780* includes all features of the Model 770 plus the capability for reading higher density tapes. (See Bulletin No. 193.)

# SPECIFICATIONS

| | | Model 765 | Model 763 | Model 702 | Model 718 |
|---|---|---|---|---|---|
| Type | | Drum | Drum | Flatbed | Flatbed |
| Maximum plot size: Y-axis | | 11" | 29½" | 31" | 54" |
| X-axis | | 120' | 120' | 34" | 72" |
| Incremental step size options (full-step/ half-step) | (1) (2) (3) (4) | .010/.005" .005/.0025" .0025/.00125" — | .010/005" .005/.0025" .0025/.00125" — | .005/.0025" .002/001" .1/.05 mm .05/.025 mm | .002/.001" .05/.025 mm — — |
| Max. incremental speed (vs. step size) in steps/second | (1) (2) (3) (4) | 450 450 450 — | 350 450 450 — | 450 450 450 450 | 450 450 — — |
| Max. Zip Mode speed (vs. step size) in steps/second | (1) (2) (3) (4) | 1687 1687 1687 — | 1312 1687 1687 — | 1687 1687 1687 1687 | 1687 1687 — — |
| Inputs | | Binary-coded five-bit command signals at logic levels of 0 volts (false) and +8 volts (true); clock pulses at nominal incremental speed; plot enable signal at 0 volts (false) and +8 volts (true) ||||
| Power requirements (Models 765 and 763 only. For Flatbeds, see Bulletins 200, 201) | | 115 vac ± 10%, single phase, 60 cps, also available to operate at other voltages and frequencies. ||||





## APPLICATIONS

The applications for CalComp digital plotting systems are as numerous and varied as the applications for the computers they complement. In every branch of government, in every scientific field, in industry and business, CalComp digital plotters and plotting systems have proved their accuracy, reliability, and efficiency. *Any computer output data that can be reduced to graphic form manually can be automatically plotted on CalComp equipment* — faster, with greater precision, and usually at lower cost.

## SOFTWARE SUPPORT

CalComp's staff of skilled programmers has one basic assignment: to provide our customers with the most comprehensive software support possible. This has always been a CalComp policy, because we know that it is good business — and that in the computer world, quality software is just as important as quality hardware. One important result of this policy: CalComp customers are able to put their plotting system to work as soon as it is delivered. And, equally important, they find that digital plotting is an easy task.

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Phone (714) 774-9141     TWX 910-591-1154

718

*PRELIMINARY PRODUCT NOTE*

# MODEL 718  DIGITAL ZIP MODE® PLOTTER
# FLAT BED TYPE

C
A
L
C
O
M
P

The CalComp Model 718 is one of several models available in the Zip Mode® 700 series, suitable for automatic digital plotting with virtually any standard computer, on-line or off-line. The exclusive CalComp Zip Mode, a feature of all 700 series plotters, provides very high-speed plotting of smooth curves and straight lines. The "electronic gear shift", another CalComp exclusive, provides full-step/half-step intermix for improved resolution. The large, flat plotting surface, 54 x 72 inches, is especially suited to on-line operations where real-time graphic output is required, and to automatic drafting applications. Either ballpoint or liquid ink pens may be used for production of high quality plots of computer output data, with unvarying accuracy.

Completely digital, high-resolution plotting,
on-line or off-line

Incremental speed 450 steps/second, Zip Mode
speed 1687 steps/second

Full-step/half-step "electronic gear shift" for
better resolution

Stationary, visible plotting surface
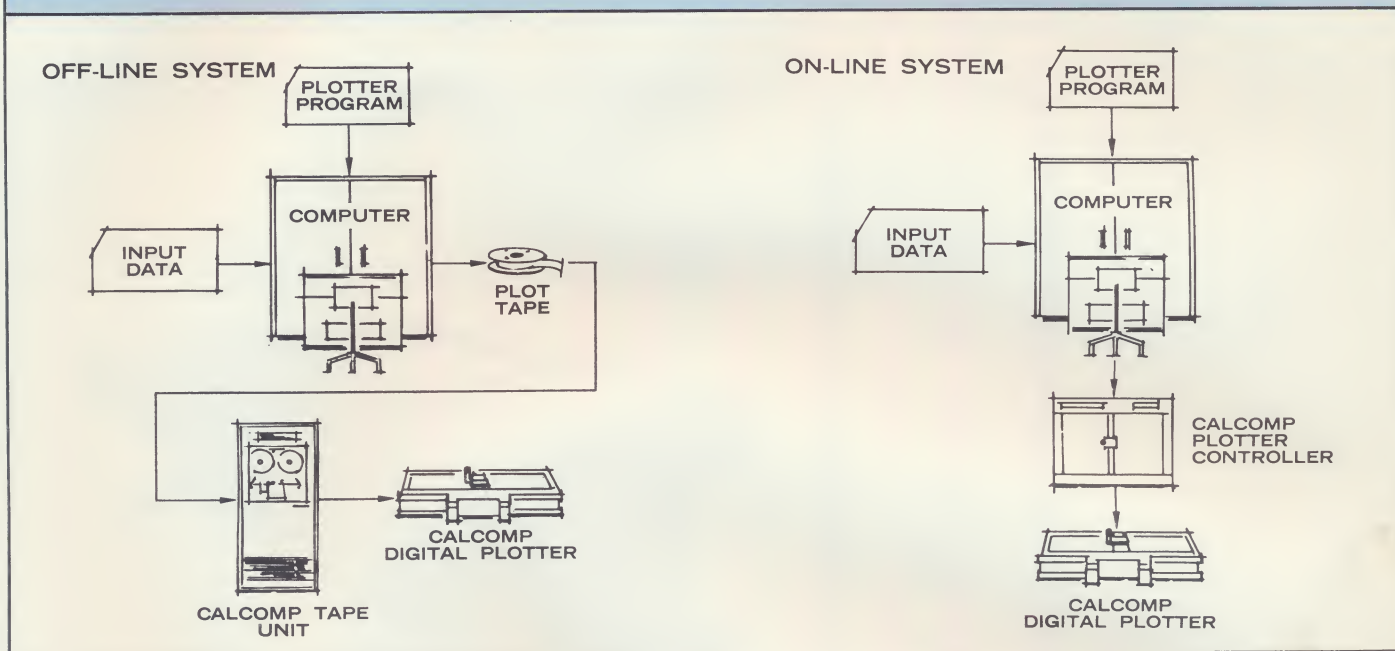
Plotting area 54 x 72 inches

Compatible with wide variety of preprinted
forms and special materials

BASIC PLOT STEPS FOR
CALCOMP 700 SERIES PLOTTERS



## PRINCIPLES OF OPERATION

All CalComp 700 series Digital Zip Mode® Plotters operate on the same basic principle. Bidirectional step motors are used for the X and Y axes and the plot is produced by movement of a pen relative to the surface of the recording paper. Coded input commands select either incremental or Zip Mode operation. In the incremental mode, each input plot command produces one incremental step in the X or Y axis, or a combined X and Y movement, in either the positive or negative direction. In addition, the command codes provide for either full-step or half-step increments, or any X and Y axis full-step/half-step intermix. These combinations provide a total of 24 basic plot steps, as shown in the diagram. Additional command codes are used to raise or lower the recording pen. In the Zip Mode, each input plot command represents a velocity increment and causes an increase or decrease in speed relative to either axis, or both axes. Maximum speed in the Zip Mode is 3.75 times the maximum incremental speed.

In the flatbed plotters (Model 702 and 718), Y-axis commands cause the pen carriage to move upward or downward, and X-axis commands cause the beam to move left or right. The incremental step size is determined by the gearing in the plotter, and several options are available. Maximum incremental and Zip Mode rates are dependent on the model and step size. Manual controls are provided on the plotter for positioning the pen to any desired location on the plotting surface, and for raising and lowering the pen.

When the digital plotter is used in an off-line system, the plot data and associated control commands are prerecorded on magnetic tape. The tape is then played back on a CalComp magnetic tape unit. The tape unit includes control logic circuits which locate the plot data on the tape, and supply the X and Y axis drive signals, mode selection signals, and the pen-up or pen-down (Z-axis) commands to the plotter.

When the plotter is used in an on-line system, the plot data and control commands are supplied directly to the plotter through a CalComp Plotter Controller.

Manloading chart for a major development program—one of hundreds of applications for CalComp digital incremental plotter.

**OFF-LINE TAPE UNIT**

**ON-LINE PLOTTER CONTROLLER**

## OFF-LINE OPTIONS

The CalComp product line includes two magnetic tape plotting systems for off-line digital plotting with the 700 series Digital Zip Mode Plotters. The *Model 770* system incorporates a number of special features for ease of tape handling and plotting flexibility. (See Bulletin No. 192.) The *Model 780* includes all features of the Model 770 plus the capability for reading higher density tapes. (See Bulletin No. 193.)

## ON-LINE OPTIONS

CalComp also offers a selection of Plotter Controllers for on-line digital plotting with the 700 series plotters. These units include a number of operator convenience features and options for increased computer efficiency and plotting flexibility. For detailed information, contact "CalComp Marketing" or your local Sales Representative.

# SPECIFICATIONS

| | | Model 765 | Model 763 | Model 702 | Model 718 |
|---|---|---|---|---|---|
| Type | | Drum | Drum | Flatbed | Flatbed |
| Maximum plot size: Y-axis | | 11″ | 29½″ | 31″ | 54″ |
| X-axis | | 120′ | 120′ | 34″ | 72″ |
| Incremental step size options (full-step/ half-step) | (1) | .010/.005″ | .010/.005″ | .005/.0025″ | .002/.001″ |
| | (2) | .005/.0025″ | .005/.0025″ | .002/.001″ | .05/.025 mm |
| | (3) | .0025/.00125″ | .0025/.00125″ | .1/.05 mm | — |
| | (4) | — | — | .05/.025 mm | — |
| Max. incremental speed (vs. step size) in steps/second | (1) | 450 | 350 | 450 | 450 |
| | (2) | 450 | 450 | 450 | 450 |
| | (3) | 450 | 450 | 450 | — |
| | (4) | — | — | 450 | — |
| Max. Zip Mode speed (vs. step size) in steps/second | (1) | 1687 | 1312 | 1687 | 1687 |
| | (2) | 1687 | 1687 | 1687 | 1687 |
| | (3) | 1687 | 1687 | 1687 | — |
| | (4) | — | — | 1687 | — |
| | | Binary-coded five-bit command signals at logic levels of 0 volts false and +8 volts (true); clock pulses at nominal incremental speed; plot enable signal at 0 volts (false) and +8 volts (true) | | | |
| Power requirements (Models 702 and 718 only. For Drums see Bulletins 196, 197.) | | 115 vac ±10%, single phase, 60 cps, also available to operate at 208 or 230V, 50/60 Hz. | | | |





## APPLICATIONS

The applications for CalComp digital plotting systems are as numerous and varied as the applications for the computers they complement. In every branch of government, in every scientific field, in industry and business, CalComp digital plotters and plotting systems have proved their accuracy, reliability, and efficiency. *Any* computer output data that can be reduced to graphic form manually can be automatically plotted on CalComp equipment—faster, with greater precision, and usually at lower cost.

## SOFTWARE SUPPORT

CalComp's staff of skilled programmers has one basic assignment: to provide our customers with the most comprehensive software support possible. This has always been a CalComp policy, because we know that it is good business—and that in the computer world, quality software is just as important as quality hardware. One important result of this policy: CalComp customers are able to put their plotting system to work as soon as it is delivered. And, equally important, they find that digital plotting is an easy task.

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*665*

*PRELIMINARY PRODUCT NOTE*

# MODEL 665 DIGITAL INCREMENTAL PLOTTER
# DRUM TYPE

CALCOMP



*The CalComp 600 series gives you unmatched flexibility for meeting your present and future digital plotting needs; the 600's bring compatibility to the full CalComp line.*

The CalComp Model 665 plots on-line with most CalComp interface units and off-line with magnetic tape unit Models 750, 760, 770 and 780. Model 665 is program-compatible with plotters in the Model 500 and 700 series, and has a maximum step-rate of 900 increments per second. With 500 series plotter input format, full-step or half-step increments are manually selectable; with 700 series input format, programmable full-step, half-step or full-step/half-step intermix provides smooth resolution.

OFF-LINE SYSTEM

PLOTTER PROGRAM
INPUT DATA
COMPUTER
PLOT TAPE
CALCOMP TAPE UNIT
CALCOMP DIGITAL PLOTTER

ON-LINE SYSTEM

PLOTTER PROGRAM
INPUT DATA
COMPUTER
CALCOMP PLOTTER CONTROLLER
CALCOMP DIGITAL PLOTTER

Program-compatible with CalComp 500 and 700 series plotters

Incremental rate up to 900 steps per second

Full-step/half-step "electronic gear shift" inter-mix or manual selection of full-step/half-step

Optional step size

Completely digital, high-resolution plotting

Fully automatic operation, on-line or off-line

Wide selection of plain or pre-printed paper

No paper alignment required



ON-LINE PLOTTER CONTROLLER



OFF-LINE TAPE UNIT

BASIC STEPS
700 SERIES INPUT

BASIC STEPS
500 SERIES INPUT

## PRINCIPLES OF OPERATION

CalComp 600 series digital plotters use bi-directional step motors for the X and Y axes and the plot is produced by the movement of the pen relative to the surface of the recording paper.
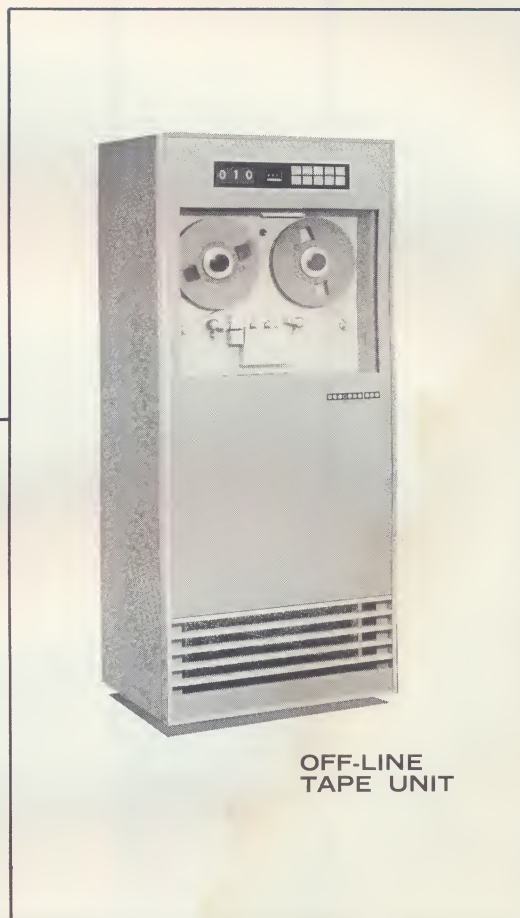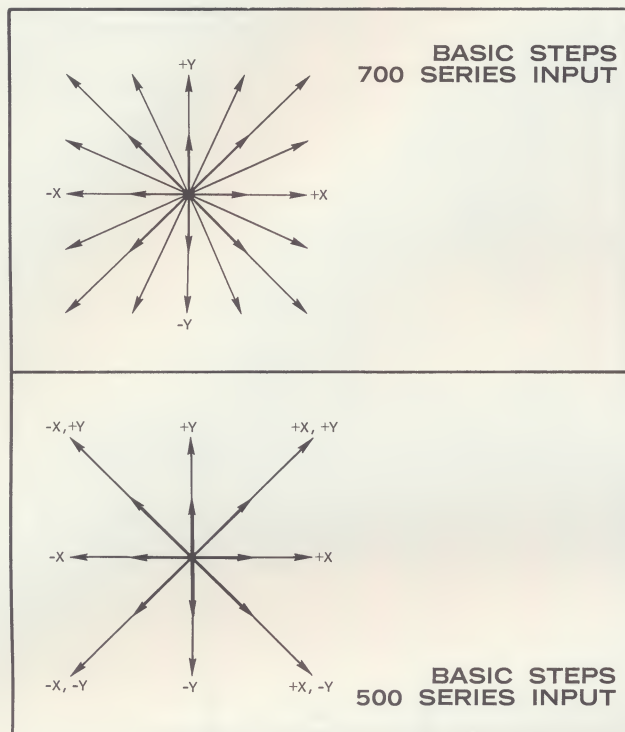
Two basic step patterns are utilized (see diagrams) because 600 series plotters accept both the 500 series input format and the 700 series input format. When using the 500 series input, the operator uses a manual switch to select full-step or half-step increments. Each input plot command produces one incremental movement in the X or Y axis, or a combined X and Y movement, either positively or negatively, in one of eight different directions. Half-steps provide a total of 16 basic plot steps. A Y axis command causes the pen carriage to move one increment to the left or right; an X axis command causes the drum to move one step up or down. Additional commands raise or lower the pen.

When the 700 series input format is used, coded input commands produce steps in the X or Y axis in 16 different step directions; half-steps provide a total of 24 basic plot steps, as shown in the diagram. Command codes provide full-step or half-step increments, or an intermix of full- and half-steps. Additional codes raise or lower the pen.

Manual controls on the plotter provide for positioning of the drum and pen carriage, and for raising and lowering the pen.

## OFF-LINE OPERATION

When the Model 665 digital plotter is used in an off-line system, the plot data and associated control commands are pre-recorded on magnetic tape. The tape is then played back on a CalComp magnetic tape unit. The tape unit includes control logic circuits which locate the plot data on the tape; decoding circuits supply operating commands to the plotter.

## OFF-LINE OPTIONS

CalComp's full line of magnetic tape systems provides complete off-line plotting capabilities for the 600 series of digital plotters.

### 500 SERIES INPUT

Model 750 — provides ease of tape handling and high plotting flexibility (see Bulletin #190).

Model 760 — all capabilities of the 750, plus tape format that increases plotting efficiency by reducing computer time and tape quantity (see Bulletin #191).

### 700 SERIES INPUT

Model 770 — essentially the same features as the 760, but with capability to handle the 700-series input format (see Bulletin #192).

Model 780 — all capabilities of the 770, with added ability to handle higher density tapes (see Bulletin #193).

## ON-LINE OPERATION

When the 665 plotter is used in an on-line computer system, the plot data and control commands are supplied directly to it through a CalComp Plotter controller or adapter, or through interface electronics supplied by the computer manufacturer.
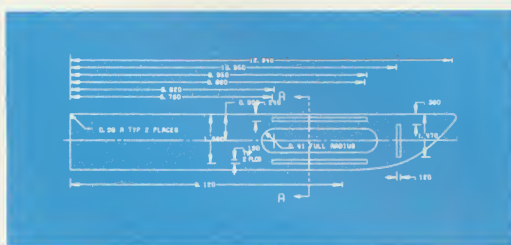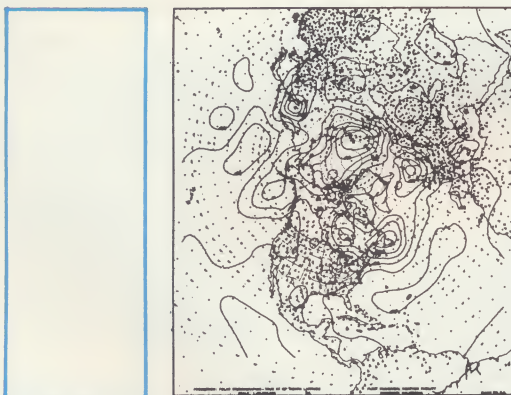
## ON-LINE OPTIONS

A wide range of CalComp interface units for use with the 665 plotter gives most standard computers high-speed on-line digital plotting capabilities. For detailed information, contact CalComp Marketing or your local sales representative.

## CALCOMP

*QUALITY STANDARD OF THE PLOTTING INDUSTRY*

## SPECIFICATIONS

| | | Model 665 | Model 663 |
|---|---|---|---|
| **Type** | | Drum | Drum |
| **Maximum Plot Size** | Y axis | 11" | 29.5" |
| | X axis | 120' | 120' |
| **Incremental step size options** (full-step / half-step) | (1) (2) (3) | .010 /.005" .005 /.0025" .0025/.00125" | .010 /.005" .005 /.0025" .0025/.00125" |
| **Maximum incremental speeds** (vs. Step Size) in Steps/Second | (1) (2) (3) | 450/900 450/900 450/900 | 350/700 450/900 450/900 |
| **Plotter Dimensions** | D W H | 15.5" 20.6" 10.2" | 15.5" 40.12" 10.2" |
| **Table Dimensions** | D W H | 21" 48" 29" | 21" 48" 29" |
| **Inputs      500 series** format | | Positive or negative polarity pulses, amplitude greater than 10v, rise time less than 10 $\mu$sec, minimum pulse width 4 $\mu$sec, source impedance less than 500 ohms. | |
| **700 series** format | | Binary-coded five-bit command signals at logic levels of 0 volts (false) and +8 volts (true); clock pulses at nominal incremental speed; plot enable signal at 0 volts (false) and +8 volts (true). | |
| **Power Requirements** | | Standard —115 vac ±10%, single phase, 60 Hz (Other voltages and frequencies available.) | |





## APPLICATIONS

CalComp digital plotting systems will automatically plot any computer output data that you can reduce to graphic form manually—faster, more accurately, and usually at lower cost. CalComp systems are in wide use with many different computer systems in business and industry, in scientific fields, and in government. They have proved their accuracy, reliability and efficiency.

## SOFTWARE

CalComp backs its hardware with a staff of skilled programmers who provide every aspect of quality software. As a result, you can put your system to work immediately when it is delivered, whether it be for on-line or off-line applications. Ask CalComp Marketing about its comprehensive programming services, ranging from indoctrination of your personnel all the way through the development of completely new applications.

**FOR MORE INFORMATION ABOUT CALCOMP PRODUCTS AND SERVICES CONTACT "MARKETING" OR YOUR LOCAL SALES REPRESENTATIVE**

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110

# MODEL 110 PLOTTER CONTROLLER FOR IBM SYSTEM/360

C A L C O M P

CALCOMP MODEL 110
WITH MODEL 765
DIGITAL ZIP MODE PLOTTER

## DESIGN FEATURES

Modular electronic design provides for convenient and inexpensive upgrading.

Cabinet can be expanded to include electronics for 600 and 700 series plotters.

Sense switches provide extra operator convenience and improved plotting efficiency.

Compatible for on-line operation with all CalComp digital incremental plotters.

Optional core buffers for improved efficiency.

Optional dual channel feature for multiple plotter operation.

Tie-in with System/360 power control interface.

## DESCRIPTION

The CalComp Model 110 Plotter Controller is designed to provide on-line operation of any CalComp 500, 600, or 700 series digital plotter and the Model 835 Electronic Digital Plotter with the IBM System/360. The Model 110 provides the on-line controlling and decoding functions for attaching a plotter to a System/360 Multiplexor or Selector I/O channel.

The Model 110 is designed in modular form for the inclusion or addition of an optional 2048 or 4096 character core buffer. An optional dual channel feature is also available for driving several plotters simultaneously.

Operator convenience features include a number of manual controls and indicators, plus six special sense switches that can be used to inform the computer of the operational status or to identify plotting modes. The sense switch functions can be changed at the option of the programmer. Typical program provisions for the sense switches might include:

Single Plot — Stop after finishing one plot
(This could be used for changing pens, adding ink, or replenishing plotter paper)

Multiple Plot — Plot until end of data or until otherwise instructed

Repeat Last Plot — Repeat the last plot

Change Scale — Change the scale factor of data to be plotted

The Model 110 includes the following manual switches and indicators in addition to the six sense switches:

INTERRUPT — Manual switch; signals the computer to interrogate the sense switches; indicator remains on until computer has accepted the instruction

RESET — Manual switch; terminates plot function and establishes necessary conditions for accepting new data; used at start of ON-LINE operation, or as a ''panic stop''

ON-LINE — Indicator; lights when conditions necessary for receiving data from computer are established by internal toggle switch

OFF-LINE — Indicator; lights when unit has been disconnected from the channel for test purposes; operates in conjunction with internal toggle switch; cannot be activated unless computer is in Halt or Wait status

SELECT — Indicator; lights only during the time data is being transferred from the computer to the 110 Plotter Controller; normally visible only when operating in Burst Mode

BUSY — Indicator; lights during plotting periods and/or when a status is outstanding; Outstanding Status includes one or more of the following:
(1) Manual interrupt
(2) Device end
(3) Channel end
(4) Unit check

UNIT CHECK — Indicator; lights when a malfunction has occurred, causing a sense byte to be sent to the computer; indicates one of the following:
(1) Plotter not ready (600, 700 and 800 series)
(2) Bus out parity error during data transfer
(3) Core buffer parity error (when provided)
(4) Overrun (channel did not respond in time, 700 series plotter and unbuffered basic unit only)
(5) Low paper (option)
(6) Plotter limit switch actuated (option)

# SYSTEM OPERATION

## Basic Model 110

The basic Model 110 with single-character buffer connects to and operates with the Multiplexor channel via an I/O interface section. (Operation on the Selector channel is not recommended except with one of the core buffer options.) The I/O interface consists of byte-buses for commands, addresses, data, or status and channel interlock controls. The interlocks establish priorities among the other control units attached to the I/O channel.

Operation is initiated by a program command given by the channel and accepted by the Model 110. The unit cannot be addressed again until it has presented the terminating status to the channel.

Operation with the basic Model 110 on the Multiplexor channel is normally in the "byte" mode. ("Burst" mode operation is normally used only with one of the core buffer options.) In the byte mode the Model 110 releases the I/O channel after initial selection, after transferring each byte of data, and prior to presenting the terminating status.

Three I/O instructions are used to operate the 110: start I/O, test I/O, and halt I/O. CalComp supplies programming routines to execute the I/O operations. When a plot is to be performed, a CalComp routine prepares a list of channel command words (CCW) in main storage. The CCWs may contain the following plotter commands:

(1) Reset and Start Write

(2) Write

(3) Sense (Basic)

(4) Sense (Switches)

(5) Start Plot

(6) No-op Control

When the channel command words have been formed, the program specifies the channel and address of the plotter. The execution of a start I/O instruction causes the command, count, data address, and control information to be stored in a specified sub-channel of the Multiplexor channel. The channel then selects the Plotter Controller and presents the command to it. If the command is valid, it is accepted. The channel then indicates to the program if the start I/O command was successful. Once the command has been accepted by the channel and the Plotter Controller, the CPU (Central Processing Unit) is unaware of the continuance of the operation until the entire data area has been transmitted.

As a part of the initial selection sequence, the Model 110 presents a status byte to the channel to indicate one of the following:

(1) Manual interrupt

(2) Outstanding status

(3) Channel end status

(4) Device end status (plotting completed)

(5) Unit check

If unit check is indicated, the Model 110 presents a sense byte indicating one of the following:

(1) Plotter not ready (600, 700 and 800 series)

(2) Bus out parity error

(3) Core buffer parity error (when provided)

(4) Overrun (channel did not respond in time to service the Model 110, unbuffered basic model, with 700 series plotter attached)

(5) Low paper (option)

(6) Plotter limit switch actuated (option)

If the manual interrupt status is indicated, this normally signifies that a sense switch entry was made and the Model 110 presents a second sense byte to the channel indicating the status of the sense switches.

These switches provide simplified and improved efficiency of operation for the on-line plotting system. The programmer may assign various functions to the sense switches, as described previously.

Because the channel contains all necessary information relative to current operation, data transfer between the main storage and the Model 110 can be overlapped with the CPU processing. The extent of overlap depends upon the type of channel (Multiplexor or Selector) and the processor (Model 30, 40, 50, etc.) of the System/360.

## Model 110 with Core Buffer

The core buffer options provide storage of 2048 or 4096 characters at the input to the plotter, and offer a significant increase in efficiency and flexibility of operation. These options permit operation on the Selector channel, or on the Multiplexor channel in the burst mode. Burst mode operation provides maximum efficiency.

"Burst" loading of the core buffer may be accomplished in bursts of any size, in random fashion, through command chaining of "WRITE" CCWs. When the buffer is full enough to warrant initiation of buffer-readout to the plotter, the computer executes a "start plot" CCW. During this time, the buffer outputs its contents to the plotter at the appropriate plotter rate. Device end status response triggers new CCWs if desired.

## Model 110
## with Dual Channel Feature

This option provides a modified output section in the Model 110 to permit simultaneous, independent operation of two CalComp plotters. The dual channel feature switches alternate input characters to the channel A and channel B outputs. Two different plotter models may be connected to the A and B outputs if desired, including a 700 series plotter operating in the Zip Mode (high-speed, synchronous plotting). A manual selector switch establishes the output mode—channel A only, channel B only, channels A and B in parallel, or dual-channel operation. The selector switch also establishes the output data rate to the plotters, which is the maximum incremental speed of the slower plotter when parallel or dual-channel operation is used. For example, if a Model 565 and 763 are multiplexed, both will run at the Model 565 speed of 300 steps per second. (In this example, the Zip Mode speed of the 763 plotter would be 3.75 x 300, or 1125 steps per second maximum.) Suitable pen delays are provided by the computer plot package. Pen delays in non-multiplexed mode may be provided either by the plot package or by the Model 110 as controlled by a toggle switch on the unit.

Two plotter output terminations are provided in each plotter channel, so that with the dual channel feature, the Model 110 is capable of driving as many as four plotters simultaneously. The two plotters connected to the same channel output must be compatible, and both receive the same data. All plotters are compatible with any other plotter in its series (e.g., Model 502 and 563), and 600 series plotters can be connected with either 500 or 700 series models.

## On-Line Operation
## with 700 Series Plotters

The CalComp 700 series digital plotters incorporate an exclusive Zip Mode which permits very high speed plotting (up to 3.75 times the maximum incremental speed) of straight lines. However, since synchronous operation is required, the timing factor must be considered when a 700 series plotter is used with the basic Model 110, which contains only a single character buffer. Data must be supplied to the Model 110 in this case at the rate of one character approximately every 2 milliseconds. Thus, if the timing on the System/360 Multiplexor channel is critical, one of the core buffer options should be included in the Model 110. In general, the basic Model 110 should be used with 700 series plotters only when there are no disk storage or tape units operating on the same Multiplexor channel.

## On-Line Operation
## with Model 835 Electronic Digital Plotter

The CalComp Model 835 Electronic Digital Plotter provides automatic, ultra high-speed recording of a cathode ray tube plot display on 35 mm microfilm. When used for on-line plotting with the Model 110, the Model 835 has a maximum plotting speed of 100,000 incremental steps per second. The plot area, at optimum magnification of 15X, is 11 by 17 inches. Up to 3200 plots may be recorded on a single 400-foot reel of microfilm. A plot viewer which provides magnification to 11 by 17 inches is also offered as an option.

# MODEL 110
## SYSTEM CONFIGURATIONS



MODEL 110/835



MODEL 110/565



MODEL 110/563



MODEL 110/765 OR 763



MODEL 110/765 OR 763 CABINET OPTION
(ALSO AVAILABLE FOR 563, 665 OR 663)

## SPECIFICATIONS FOR MODEL 110

| DIMENSIONS: | | Standard Unit | Expanded Unit* |
|---|---|---|---|
| | Width | 32 in. | 62 in. |
| | Depth | 22 in. | 22 in. |
| | Height | 37½ in. | 37½ in. |
| WEIGHT: | | 180 lbs. | 430 lbs. |

**OPTIONS:**

I  **2048 Character Core Buffer**—Plug-in module containing necessary core planes, selection and inhibit drivers, address registers, and sense amplifiers.

II  **4096 Character Core Buffer**—Same as Option I with double the storage capacity.

III  **Dual Channel Feature**—Modular option to provide two plotter channels which can be driven simultaneously in a synchronous mode. Data channels may be driven in parallel (identical data on each channel) or interlaced (alternate characters on each channel). Provides proper timing and control through a selector switch. Allows intermixing of 500, 600, and 700 series plotters on separate channels. When operating in dual channel mode, output data rate to each channel is the rate of the slowest attached plotter. Channel selection switch provides the following control positions:

Output to Plotter Channel A
Output to Plotter Channel B
Parallel Output to Channels A and B
Interlaced Output to Channels A and B

This feature available with basic unit or in combination with Option I or II.

IV  ***Expanded Unit**—Includes provisions for electronics modules for 600 or 700 series plotters.

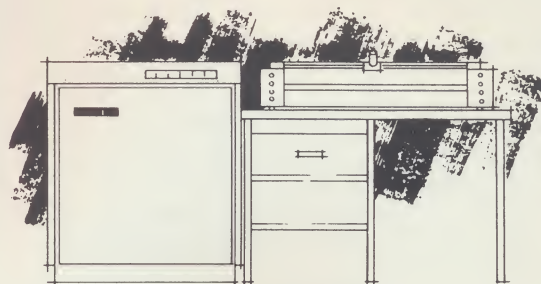V  **Data Cables**—2 required; available in 20 ft., 25 ft., or 30 ft. lengths.

**INPUT DATA RATE:** **Basic Unit**—Data transfer rate is under control of Plotter Controller and limited to maximum plotter rate.

**Buffered Unit (Option I or II)**—Data transfer rate is at maximum burst mode rate of 250 kHz when connected to Multiplexor channel. Data transfer rate is 330 kHz maximum when connected to Selector channel.

**Dual-Channel (Option III) Unbuffered Unit**—Data transfer rate is twice the rate of the slowest plotter attached, controlled by the Model 110.

**POWER:** 50/60 Hz, 208 volts, single phase power, approximately 500 watts, plus plotter requirement. Optional input power: 115, 190, or 230 vac, single phase.

## DIGITAL PLOTTERS

CalComp offers a complete line of digital plotters—a total of ten basic models for computer controlled preparation of quality ink-on-paper graphic presentations. All are suitable for either off-line or on-line operation.

### 500 Series

The CalComp 500 series includes two drum and two flatbed types, each available in a choice of incremental step sizes. Maximum incremental step rates are from 200 to 450 steps-per-second, depending upon the model. Each step, under program control, may be in any one of 8 directions.

### 600 Series

The CalComp 600 series includes two drum types, with optional incremental step sizes. These units are program-compatible with both the 500 and 700 series plotters. The 600 series plotters operate in either full-step or half-step mode, at incremental rates up to 900 steps-per-second in the half-step mode.

### 700 Series

The CalComp 700 series includes two drum and two flatbed types, with optional step sizes. The 700 series plotters operate at incremental step rates up to 450 steps-per-second, and include the exclusive Zip Mode®

for driving the plotter at several times the maximum incremental speed. Another feature is the "electronic gear-shift" which permits either full-step or half-step operation, or a combination of the two, for improved resolution. This capability results in 24 basic plot steps.

## ELECTRONIC PLOTTING

The CalComp Model 835 is a CRT/microfilm plotting system, precision engineered to provide ultra high-speed plotting and recording of any computer output data that can be converted to graphic form. Unlike whole-value CRT systems, the Model 835 is a true digital incremental plotter—utilizing the basic design principles and circuitry developed, perfected and patented by CalComp. When operated on-line with the CalComp Model 110, the Model 835 may be used in a time-shared configuration with other on-line equipment, and is capable of accepting input commands at rates up to 100,000 characters per second. The standard model is supplied with a 35 mm microfilm camera. A 16 mm camera is offered as an option. An optional film viewer is also available with the system.

## DRUM TYPE

CalComp drum type plotters are available in two sizes: a 12-inch drum and a 30-inch drum. The plot is produced by rotary motion of the drum (X-axis) and lateral motion of the pen carriage (Y-axis). Either ballpoint or liquid ink pens may be used. The drum type plotter uses special chart paper rolls and can produce continuous plots up to 120 feet in length. A wide selection of paper is available.

## FLATBED TYPE

CalComp flatbed plotters are also available in two sizes: 31 by 34 inches, and 54 by 72 inches (plot area). The plot is produced by lateral motion of the beam and vertical motion of the pen carriage. Either ballpoint or liquid ink pens may be used. The flatbed plotter provides continuous display during plotting. It does not require special paper, and can handle a large variety of preprinted forms and special materials.

| | |
|---|---|
| 12-Inch Drum | Model 565 |
| | Model 665 |
| | Model 765 |
| 30-Inch Drum | Model 563 |
| | Model 663 |
| | Model 763 |
| Plot area 31 x 34 | Model 502 |
| | Model 702 |
| Plot area 54 x 72 | Model 518 |
| | Model 718 |

FOR ADDITIONAL INFORMATION
CONTACT CALCOMP MARKETING
OR YOUR LOCAL SALES REPRESENTATIVE

CALCOMP

CALIFORNIA COMPUTER PRODUCTS, INC.
305 North Muller Street    Anaheim, California 92803
Phone (714) 774-9141    TWX 910-591-1154

# LIQUID INK ACCESSORY KITS
# BALLPOINT PEN ACCESSORY KITS

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To match the versatility of its digital plotting systems, CalComp has available as optional accessories both Liquid Ink and Ballpoint Pen Accessory Kits particularly suited to the capabilities of each of its plotter series. The pen-and-ink accessories included in each of the kits are interchangeable with the compatible Liquid Ink/Ballpoint Pen Combination assemblies supplied as standard equipment with the plotters.

## PLOTTERS/KITS

| TYPE OF KIT | GENERAL PURPOSE | HIGH-SPEED |
|---|---|---|
| BALLPOINT | *10082-101 | 10082-101-11 |
| LIQUID INK | 20-300 | 10065-101 |
| COMBINATION | **10073-101 | **10070-101 |
| | For use with Models 565, 563, 575, 502, 518, 718 — all step sizes . . . 702 — .002" — .05mm step sizes . . . 665, 663 — .005/.0025"— .0025/.00125" step sizes | For use with Models 765, 763 — all step sizes . . . 702 — .005" — .1mm step sizes . . . 665, 663 — .010/.005" step sizes . . . |

*Shipped with Models 565, 563, 575 as standard equipment.
**Shipped with other plotters as noted above as standard equipment.
Other kits available as accessories.

CalComp's pen-and-ink kits have been designed to match the specific plotting capabilities of each of its plotters. Different ink characteristics have been developed for general purpose and high-speed plotting.

Ink pens in varying sizes, from extra, extra fine to extra broad, can draw any type of computer output — from small annotation to charting. Ballpoint pens, too, are capable of drawing any graphic presentation, including maps, charts, lines, curves and graphs. Both liquid ink and ballpoint pens are available in a variety of colors.

All CalComp plotters are shipped with combination Liquid Ink/Ballpoint Pen Kits (with the exception of Models 565, 563 and 575 — which are shipped with a Ballpoint Pen Kit only).

Components in the combination pen kits are interchangeable with those in corresponding Liquid Ink or Ballpoint Pen Kits which CalComp offers as accessories. All liquid ink assemblies are interchangeable with ballpoint pen assemblies.

### DESCRIPTION
The Cap Adjustment Assembly of the Liquid Ink pen adjusts the pen travel and contains a spring-loaded pin which engages a flange on the Plunger Assembly to keep the pen from rotating. The Ink Cartridge holds the ink supply, and assembles to the Plunger Assembly by locking the Cartridge Retainer.

With both Liquid Ink and Ballpoint pens, the Plunger Assembly holds and moves the Drawing Pen in the pen-up and pen-down axis. The solenoid electrical drive to the pen is contained in the Pen Holder, which is supplied as standard equipment with the plotter.

Components of each of the Liquid Ink and Ballpoint Pen Accessory Kits are packed in a handy, hardwood case custom-fitted for convenience in storing parts. Additional storage is provided for standard accessories such as reticles, extra pens, pen holder and extra points.

Accessories such as Liquid Ink Conversion Assemblies, Liquid Ink Drawing Pens, Drawing Inks, Pen Cleaner, Ballpoint Pens, Reticles and Carrying Case may be ordered from CalComp as individual replacement parts.

Operation and service instructions are packed inside each kit.

## PEN-AND-INK COMPONENTS

| BALLPOINT COMPONENTS | PART NO. | LIQUID INK ACCESSORY KIT 20-300 | LIQUID INK ACCESSORY KIT 10065-101 | BALLPOINT ACCESSORY KIT 10082-101 | BALLPOINT ACCESSORY KIT 10082-101-11 | COMBINATION KIT 10070-101 | COMBINATION KIT 10073-101 |
|---|---|---|---|---|---|---|---|
| Large Reticle | 20-168 | | | 1 | 1 | 1 | 1 |
| Small Reticle | 20-169 | | | 1 | 1 | 1 | |
| Plunger Assembly | 20-079 | | | 1 | 1 | 1 | 1 |
| Cap Assembly | 20-118 | | | 1 | 1 | 1 | 1 |
| Body Assembly | 11631-203 | | | 1 | 1 | 1 | 1 |
| Ballpoint Pen .1mm Green (715) | B60-40C | | | 2 | 2 | 2 | 2 |
| Ballpoint Pen .1mm Blue (716) | B60-40C | | | 2 | 2 | 2 | 2 |
| Ballpoint Pen .1mm Black (719) | B60-40C | | | 2 | 2 | 2 | 2 |
| Ballpoint Pen .1mm Red (706) | B60-40C | | | 2 | 2 | 2 | 2 |
| **LIQUID INK COMPONENTS** | | | | | | | |
| Cap Adjustment Assembly | 10004-301 | 1 | 1 | | | 1 | 1 |
| Plunger Assembly | 10005-301 | 3 | 3 | | | 3 | 3 |
| Ink Cartridge | 88 | 3 | 3 | | | 3 | 3 |
| Retainer Cartridge | 10336-203 | 3 | 3 | | | 3 | 3 |
| Vial (Storage Cover) | 10364-203 | 3 | 3 | | | 3 | 3 |
| **GENERAL PURPOSE PENS AND INKS** | | | | | | | |
| ¾ oz. Black Ink | 11663-203-1 | 1 | | | | | 1 |
| ¾ oz. Blue Ink | 11663-203-2 | 1 | | | | | 1 |
| ¾ oz. Red Ink | 11663-203-3 | 1 | | | | | 1 |
| ¾ oz. Green Ink | 11663-203-4 | 1 | | | | | 1 |
| ¾ oz. Brown Ink | 11663-203-5 | 1 | | | | | 1 |
| Extra, Extra Fine Liquid Ink Pen | 11664-203-21 | 1 | | | | | 1 |
| Extra Fine Liquid Ink Pen | 11664-203-31 | 1 | | | | | 1 |
| Fine Liquid Ink Pen | 11664-203-41 | 1 | | | | | 1 |
| Medium Liquid Ink Pen | 11664-203-51 | 1 | | | | | 1 |
| Medium Broad Liquid Ink Pen | 11664-203-61 | 1 | | | | | 1 |
| Broad Liquid Ink Pen | 11664-203-81 | 1 | | | | | 1 |
| Extra Broad Liquid Ink Pen | 11664-203-101 | 1 | | | | | |
| **HIGH-SPEED PENS AND INKS** | | | | | | | |
| ¾ oz. Black Ink | 11558-203-1 | | 1 | | | 1 | |
| ¾ oz. Blue Ink | 11558-203-2 | | 1 | | | 1 | |
| ¾ oz. Red Ink | 11558-203-3 | | 1 | | | 1 | |
| ¾ oz. Green Ink | 11558-203-4 | | 1 | | | 1 | |
| Extra, Extra Fine Liquid Ink Pen | 11559-203-11 | | 4 | | | 4 | |
| Extra Fine Liquid Ink Pen | 11559-203-21 | | 4 | | | 4 | |
| Pen Cleaner (Dispenser) | 3065-F | 1 | 1 | | | 1 | 1 |
| "Rapido-eze" Cleaner (Jar) | 3068 | 1 | 1 | | | 1 | 1 |
| Magic Tape (½" x 400") | 104 | 1 | 1 | 1 | 1 | 1 | 1 |
| Carrying Case | 20-149 | | | 1 | 1 | | |
| Carrying Case | 10002-201 | 1 | 1 | | | 1 | 1 |

# INK ON
# PAPER
## DIGITAL GRAPHIC SYSTEMS

# INK ON
# PAPER
## DIGITAL GRAPHIC SYSTEMS

# CHART PAPERS FOR CALCOMP PLOTTERS
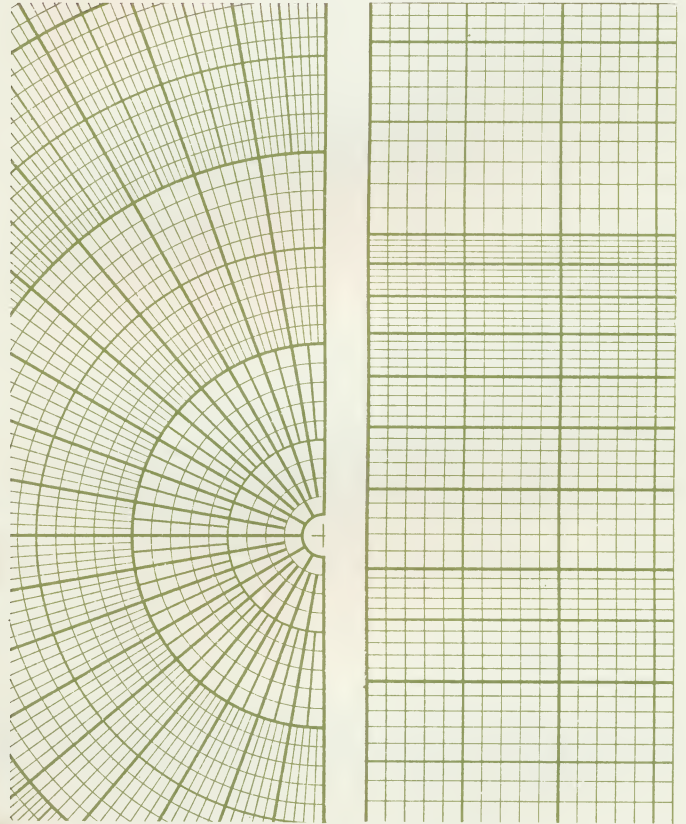
CALCOMP

CALIFORNIA COMPUTER PRODUCTS, INC.
305 N. Muller St., Anaheim, California 92803

## CALCOMP CHART QUALITY

Your CALCOMP Digital Incremental Plotter performs to exacting standards; CALCOMP chart papers are designed to match those standards and provide maximum accuracy for you in your plotting requirements.

Only the highest quality materials are used in CALCOMP charts. They are printed and die-cut under rigidly controlled atmospheric conditions in which the temperature is held to between 72 and 75 degrees Fahrenheit and relative humidity is held at 50%. Each roll is individually sealed in polyethylene and boxed to protect it during storage and shipping.

## BASIC MATERIALS

CALCOMP chart patterns in stock are maintained on translucent paper selected for the combined optimum in durability, stability, finish and transparency. Some of the more widely used charts are stocked in vellum, rag bond, mylar, triacetate and foil-backed paper. Any chart not stocked in any of these basic materials is available on special order (except Mylar for 30″ charts.) Charts are stocked in olive-brown grids; other colors are available on special order.

## SPECIAL GRID PATTERNS

If you need a grid pattern that doesn't exist, contact your sales representative or CALCOMP Marketing. Virtually any grid pattern can be created to your specifications, and our specialists will work with you to meet your individual requirements. There usually is no charge for this development work, but a minimum order is required.

## QUALITY GRIDS FOR CALCOMP PLOTTERS

+ Quality-controlled printing
+ Quality in design
+ Quality materials

## WIDE CHOICE OFF-THE-SHELF

+ Square grids
+ Rectangular grids
+ Circular grids
+ Simi-logs
+ Full logs

## CHOICE OF MATERIALS

+ TRANSLUCENT PAPER — quality finish with strength, stability and translucency to meet most plotting requirements.
+ 100% RAG BOND — brilliant white finish; document quality.
+ VELLUM — finish and texture for maximum speed in diazo process work.
+ FOIL-BACKED PAPER—strength and opacity.
+ TRIACETATE — transparency, stability, strength.
+ MYLAR — transparency with maximum strength and stability.

## SPECIAL GRIDS CREATED TO YOUR NEEDS

**Contact your sales representative
or call CALCOMP MARKETING
(714) 774-9141**

# CATALOG
## 12-INCH PLOTS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| | Y-Axis | X-Axis | | | |
| 00 | Blank | Blank | | Continuous roll | V F Te R M |
| 00AP | Blank | Blank | | Double punched for printer | |
| 00A | Blank | Blank | | Perf. to 8½" x 11" sheet size; .875" between sheet pattern | |
| 00B | Blank | Blank | | Perf. to 16" x 11" sheet size; 1.250" between sheet pattern | |

### SQUARE GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| | Y-Axis | X-Axis | | | |
| 01 | 10 div./in. | 10 div./in. | 1.0 in. | Continuous roll | V F Te R M |
| 01A | 10 div./in. | 10 div./in. | 8.25 in. | Perf. to 8¼" x 11" sheet size; grid area 7" x 10" | |
| 01B | 10 div./in. | 10 div./in. | 17.25 in. | Perf. to 17¼" x 11" sheet size; grid area 16" x 10" | |
| A01 | 10 div./in. | 10 div./in. | 1.2 in. | Continuous roll; every 6th line medium bold, every 12th line bold in X-axis; 5th and 10th lines in Y-axis | |
| 02 | 20 div./in. | 20 div./in. | 0.5 in. | Continuous roll | V F Te R M |
| A02 | 20 div./in. | 20 div./in. | 17.25 in. | Perforated; grid pattern dimensions 10" x 16"; sheet size 11" x 17¼" | |

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| | Y-Axis | X-Axis | | | |
| 03 | 25 div./in. | 25 div./in. | 0.4 in. | Continuous roll; every 5th line medium bold and every 10th line extra bold | |
| A03 | 25 div./in. | 25 div./in. | 12 in. | Perforated; grid pattern 7.6" x 10"; sheet size 8½" x 11"; printed on reverse side; 3.5" grid spacer | V |
| B03 | 25 div./in. | 25 div./in. | 0.4 in. | Continuous roll; printed on reverse side | |
| C03 | 25 div./in. | 25 div./in. | 17.250 in. | Perf. to 16" x 11" sheet size; grid spacer 1.250"; punched for 3-ring binder | |
| 04 | 1.0 div./in. | 1.0 div./in. | 1.0 in. | Continuous roll | |
| 05(1) | 10 div./cm. | 10 div./cm. | 1.0 cm. | Continuous roll | V |
| 07 | 10 div./cm. | 10 div./cm. | 17.25 in. | Perforated; grid pattern dimensions 25 x 38 cm.; sheet size 11" x 17¼" | |
| 08 | 10 div./cm. | 10 div./cm. | 12.0 in. | Perforated; grid pattern dimensions 19 x 25 cm.; sheet size 8½" x 11"; 3.5" grid spacer | V |

### RECTANGULAR GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| | Y-Axis | X-Axis | | | |
| H03 | 50 div./2.5 in. | 10 div./2.5 in. | 2.5 in. | Continuous roll | |

## PRICE LIST

| LENGTH | 120 FT. | | 60 FT. | | 120 FT. | | 60 FT. | | 60 FT. |
|---|---|---|---|---|---|---|---|---|---|
| Quantity | Translucent | | Foil | | Rag or Vellum | | Triacetate | | Mylar |
| | 12" | 30" | 12" | 30" | 12" | 30" | 12" | 30" | 12" |
| 1 Roll | 5.00 | 20.00 | 5.00 | 20.00 | 7.50 | 27.00 | 15.00 | 37.50 | 55.00 |
| 1 Carton (See note) | 112.50 (4.50) | 216.00 (18.00) | 112.50 (4.50) | 216.00 (18.00) | 168.75 (6.75) | 294.00 (24.50) | 350.00 (14.00) | 405.00 (33.75) | 1250.00 (50.00) |
| 2 - 4 Cartons | 106.25 (4.25) | 204.00 (17.00) | 106.25 (4.25) | 204.00 (17.00) | 160.00 (6.40) | 282.00 (23.50) | 337.50 (13.50) | 384.00 (32.00) | 1200.00 (48.00) |
| 5 - 9 Cartons | 100.00 (4.00) | 192.00 (16.00) | 100.00 (4.00) | 192.00 (16.00) | 150.00 (6.00) | 276.00 (23.00) | 318.75 (12.75) | 360.00 (30.00) | 1125.00 (45.00) |
| 10 - 19 Cartons | 93.75 (3.75) | 180.00 (15.00) | 93.75 (3.75) | 180.00 (15.00) | 140.00 (5.60) | 264.00 (22.00) | 300.00 (12.00) | 330.00 (27.50) | 1050.00 (42.00) |

*NOTES:
1. Numbers in parentheses are equivalent price per roll.
2. Quantity prices apply only to cartons of same size paper and same color ink.
3. 12-inch paper, 25 rolls per carton, shipping weight 32 lbs. 30-inch paper, 12 rolls per carton, shipping weight 54 lbs.
4. All prices subject to change without notice, FOB sellers plant, Anaheim, Calif.
5. Terms net 30 days.
6. For prices on quantities greater than 19 cartons, contact CalComp Marketing.

*BASIC MATERIALS

All charts are stocked in translucent paper, and those which are stocked in other basic materials are indicated as follows:

V-vellum
R-rag
F-foil-backed paper
M-Mylar
Te-Triacetate

Any chart on basic material that is not stocked is available on special order, except mylar for 30" charts.

All charts listed are open stock.

*NOTES: (1) Because of sprocket perforations (⅜" spacing), actual printed pattern is 200 divisions = 7⅞" on Chart No. 05.

(2) Because of sprocket perforations (½" spacing), actual printed pattern is 140 divisions = 5½" on Chart Nos. 305 and 405.

| Chart No. | Grid Description Y-Axis | Grid Description X-Axis | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 17 | 10 div./in. | 12 div./in. | 1.0 in. | Continuous roll; every 10th line bold in Y-axis, every 12th line bold in X-axis | |
| 17A | 10 div./in. | 12 div./in. | 1.0 in. | Continuous roll; no bold lines in Y & X | |
| Y1 | 10 div./in. | 12 div./0.96 in. | 0.96 in. | Continuous roll | V |

### SEMI-LOG GRIDS

| Chart No. | Grid Description Y-Axis | Grid Description X-Axis | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 06 | 20 div./in. | 1 cycle log (2.5" cycle) | 2.5 in. | Continuous roll | |
| 09 | 10 div./in. | Log (7.5" cycle) | 7.5 in. | Continuous roll | |
| A09 | 10 div./in. | Log (3" cycle) | 3 in. | Continuous roll | |
| 10 | 1 cycle log (10" cycle) | 10 div./in. | 1.0 in. | Continuous roll | V |
| 10A | 1 cycle log (10" cycle) | 12 div./in. | 1.0 in. | Continuous roll | |
| 15 | 1 cycle log (10" cycle) | 25 div./in. | 0.4 in. | Continuous roll | |
| 20 | 2 cycle log (5" cycle) | 10 div./in. | 1.0 in. | Continuous roll | V |
| 25 | 2 cycle log (5" cycle) | 25 div./in. | 0.4 in. | Continuous roll | |
| 30 | 3 cycle log (3.33" cycle) | 10 div./in. | 1.0 in. | Continuous roll | V |
| 35 | 3 cycle log (3.33" cycle) | 25 div./in. | 0.4 in. | Continuous roll | |
| 36 | 3.2 cycle log (2" cycle) | 8 div./in. | 1.5 in. | Continuous roll; every 12th horizontal line bold; initials for 12 months of year | |
| 40 | 4 cycle log (2.5" cycle) | 10 div./in. | 1.0 in. | Continuous roll | V |
| A40 | 4 cycle log (2.5" cycle) | 10 div./in. | 17.25 in. | Perforated; grid pattern dimensions 10" x 16"; sheet size 11" x 17¼" | |
| 48 | 4 cycle log (2.5" cycle) | 10 div./in. | 12 in. | Perforated; grid pattern 7" x 10"; sheet size 8½" x 11"; 3.5" grid spacer | |
| A48 | 4 cycle log (2.5" cycle) | 10 div./in. | 9.375 in. | Perforated; grid pattern dimensions 7" x 10"; sheet size 8½" x 11"; .875" grid spacer | |
| 51 | 5 cycle log | 10 div./in. | 4.0" | Continuous roll | |
| A51 | 5 cycle log (2" cycle) | 10 div./in. | 12 in. | Perforated; grid pattern 7.5" x 10"; sheet size 8½" x 11"; reverse print; 3.5" grid spacer | |
| 60 | 6 cycle log (1.7" cycle) | 10 div./in. | 1.0 in. | Continuous roll | |
| 70 | 7 cycle log (1.4" cycle) | 10 div./in. | 0.5 in. | Continuous roll | |

### FULL LOG GRIDS

| Chart No. | Grid Description Y-Axis | Grid Description X-Axis | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 11 | 1 cycle log (10" cycle) | Log (7.5" cycle) | 7.5 in. | Continuous roll | V |
| 21 | 2 cycle log (5" cycle) | Log (7.5" cycle) | 7.5 in. | Continuous roll | V |
| 22 | 2 cycle log (5" cycle) | 5 cycle log (5.0" cycle) | 5.0 in. | Continuous roll | |
| 31 | 3 cycle log (3.33" cycle) | Log (7.5" cycle) | 7.5 in. | Continuous roll | V |
| 41 | 4 cycle log (2.5" cycle) | Log (2.5" cycle) | 2.5 in. | Continuous roll | |

| Chart No. | Grid Description Y-Axis | Grid Description X-Axis | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 44 | 4 cycle log (2.5" cycle) | 4 cycle log (1.75" cycle) | 12.0 in. | Perforated; grid pattern dimensions 7" x 10"; sheet size 8½" x 11"; 3.5 grid spacer | |
| A44 | 4 cycle log (2.5" cycle) | 4 cycle log (1.75" cycle) | 9.375 in. | Perforated; grid pattern dimensions 7" x 10"; sheet size 8½" x 11"; .875" grid spacer | |
| 50 | 5 cycle log (2" cycle) | Log (2.0" cycle) | 2.0 in. | Continuous roll | |
| A53 | 5 cycle log (1.85" cycle) | 3 cycle log (1.85" cycle) | 12 in. | Perforated; grid pattern 9.25" x 5.55"; sheet size 8½" x 11"; 3.5" grid spacer | |

### CIRCULAR GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| NAV 4 | 0° -360°, Polar Grid | | 12 in. | Perf. to 8½" x 11" sheet size; 3.5" spacer between sheets | |
| P2 | Preprinted Polar Coordinates 0° -360°, 10 div. | | 12 in. | Perforated; grid pattern dimensions 7" x 10"; sheet size 8½" x 11"; 3.5" grid spacer | |
| P3 | Preprinted Polar Coordinates 0° -360°, 10 div. | | 12 in. | Perforated; grid pattern dimensions 10" x 10"; sheet size 11" x 12" | |

### SPECIAL PATTERNS

| Chart No. | Grid Description Y-Axis | Grid Description X-Axis | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 01 Prob. | Probability Grid | 10 div./7 in. | 12 in. | Perf. to 8½" x 11" sheet size; 3.5" grid spacer | |
| 40 Prob. | 4 div./in. | Prob. grid 01-99.99 | 12 in. | Perf. to 11" x 11" sheet size; 2.5" grid spacer | |
| Smith Chart | Smith Pattern | | 12 in. | Perf. to 8½" x 11" sheet size; 3.5" grid spacer | |
| 82 | 4 div./in. | 10 div./in. | | Continuous; used for well formation analysis | |
| W2 | Preprinted World Map with 20 div./in. | | 24.0 in. | Perforated; grid pattern dimensions 9" x 18"; sheet size 11" x 20"; 4" grid spacer | V |

### 30-INCH PLOTS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 300 | Blank | | | Continuous roll | V F R Te |
| B301 | 10 div./in. | 10 div./in. | 1.2 in. | Continuous roll; every 6th line medium bold, every 12th line bold in X-axis; 5th and 10th lines in Y-axis | |
| B307 | 10 div./cm. | 10 div./cm. | 17.25 in. | Perf. grid pattern 25 x 38 cm.; 11" x 17¼" sheet size | |

### SQUARE GRIDS

| Chart No. | Grid Description Y-Axis | Grid Description X-Axis | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 301 | 10 div./in. | 10 div./in. | 1.0 in. | Continuous roll | V F R Te |
| 301D | 10 div./in. | 10 div./in. | 1.0 in. | Continuous dot pattern; perforated to 23.5" running along X direction | |

(3) To use 400 Series charts on Model 563 plotters, use Paper Conversion Kit 11229-203; for Models 663 and 763, use 11410-203.

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| | Y-Axis | X-Axis | | | |
| A301 | 10 div./in. | 20 div./in. | 1.2 in. | Continuous roll; every 12th horizontal line extra bold | |
| 302 | 20 div./in. | 20 div./in. | 0.5 in. | Continuous roll | V F R |
| 303 | 25 div./in. | 25 div./in. | 0.4 in. | Continuous roll; every alternate 5th line medium bold and every 10th line extra bold | |
| 304 | 1.0 div./in. | 1.0 div./in. | 1.0 in. | Continuous roll | |
| 305 (2) | 10 div./cm. | 10 div./cm. | 1.0 cm. | Continuous roll | |
| 308 | 10 div./cm. | 10 div./cm. | 12.0 in. | Perforated; grid pattern dimensions 19 x 25 cm.; sheet size 8½" x 11"; 3.5" grid spacer | |

### RECTANGULAR GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| H303 | 50 div./2.5 in. | 10 div./2.5 in. | 2.5 in. | Continuous roll; every alternate 5th line medium bold and every 10th line extra bold | |
| 317 | 10 div./in. | 12 div./in. | 1.0 in. | Continuous roll; every 12th line bold in X-axis, every 10th line in Y-axis | |

### SEMI LOG GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 332Y | Log (3" cycle) | 12 div./.700 in. | 17.25 in. | Perforated; grid pattern 22.7" x 14"; sheet size 17¼" x 29"; | |
| 350 | 5.6 cycle log (5" cycle) | 10 div./in. | 1.0 in. | Continuous roll | |

### FULL LOG GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 351 | 5.6 cycle log (5" cycle) | Log (7.5" cycle) | 7.5 in. | Continuous roll | |
| 371 | 7 cycle log (4" cycle) | Log (4.0" cycle) | 4.0 in. | Continuous roll | |

## 12.38-INCH PLOTS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 400 | Blank | | | Continuous roll; 12 inches wide | V |
| 400C | Blank | Blank | | Continuous roll | |

### SQUARE GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 401 | 10 div./in. | 10 div./in. | 1.0 in. | Continuous roll; 12 inches wide | V |
| 401A | 10 div./in. | 10 div./in. | 8.50 in. | Perforated to 8½" x 11" sheet size; grid area 7" x 10" | |
| 401B | 10 div./in. | 10 div./in. | 17 in. | Perforated to 17" x 11" sheet size; grid area 15" x 10" | |

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| | Y-Axis | X-Axis | | | |
| A401 | 10 div./in. | 10 div./in. | 1.2 in. | Continuous roll | |
| 402 | 20 div./in. | 20 div./in. | 0.5 in. | Continuous roll; 12 inches wide | |
| 403 | 25 div./in. | 25 div./in. | 0.4 in. | Continuous roll; 12 inches wide | |
| A403 | 25 div./in. | 25 div./in. | 12 in. | Perf. to 8½" x 11"; printed on non-recording side | |
| B403 | 25 div./in. | 25 div./in. | | Continuous roll; printed on non-recording side | |
| 404 | 1.0 div./in. | 1.0 div./in. | | Continuous roll | |
| 405 (2) | 10 div./cm. | 10 div./cm. | 1.0 cm. | Continuous roll; 12 inches wide | V |
| 406Y | 10 div./in. | 10 div./in. | | Continuous; every 6th line med. bold, every 12th line bold in X-axis | |
| 407 | 10 div./cm. | 10 div./cm. | 17.25 in. | Perf. grid pattern, 25 x 38 cm.; 11" x 17¼" sheet size | |
| 408 | 10 div./cm. | 10 div./cm. | 12.0 in. | 12" wide; perforated; grid pattern 19 x 25 cm.; sheet size 8½" x 11"; 3.5" grid spacer | V |

### RECTANGULAR GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| Y401 | 10 div./in. | 12 div./0.96 in. | 0.96 in. | Continuous roll; 12 inches wide | |
| 417 | 10 div./in. | 12 div./in. | 1.0 in. | Continuous roll | |

### SEMI-LOG GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 406 | 20 div./in. | 1 cycle log (2.5" cycle) | 2.5 in. | Continuous roll; 12 inches wide | |
| 410 | 1 cycle log (10" cycle) | 10 div./in. | 1.0 in. | Continuous roll; 12 inches wide | |
| 430 | 3 cycle log (3.33" cycle) | 10 div./in. | 1.0 in. | Continuous roll; | |
| 436 | 3.2 cycle log (2" cycle) | 8 div./in. | 1.5 in. | Continuous roll; 12" wide; every 12th horizontal line bold, initials for 12 months of year | |
| 440 | 4 cycle log (2.5" cycle) | 10 div./in. | 1.0 in. | Continuous roll; 12 inches wide | |
| 448 | 4 cycle log (2.5" cycle) | 10 div./in. | 12 in. | Perf. to 8½" x 11" sheet size; 7" x 10" grid pattern; 3.5" grid spacer | |
| 470 | 7 cycle log (1.4" cycle) | 10 div./in. | 0.5 in. Cont. | Continuous pattern | |

### FULL LOG GRIDS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| 432 | 3 cycle | 2 cycle | 12 in. | Perf. to 8½" x 11" sheet size; punched for 3-ring binder, ¼" holes | |

### SPECIAL PATTERNS

| Chart No. | Grid Description | | Repeat Pattern | Chart Paper Features | Basic Matl. Stkd. |
|---|---|---|---|---|---|
| P426A | World Polar sterographic chart | | 17.250 in. | Perf. to 16½" x 11" sheet size | |
| 482 | 4 div./in. | 10 div./in. | | Continuous; used for well formation analysis | |

# MODEL 763 DIGITAL ZIP MODE ® PLOTTER
## DRUM TYPE



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The CalComp Model 763 is one of several models available in the Zip Mode® 700 series. The unit is suitable for automatic, high-speed digital plotting with virtually all standard computers, on-line or off-line. The exclusive CalComp Zip Mode, a feature of all 700 series plotters, provides very high-speed plotting of smooth curves and straight lines, plus a significant reduction in computer time and magnetic tape. The "electronic gear shift," another CalComp exclusive, provides full-step/half-step intermix for improved accuracy and resolution. Either ballpoint or liquid ink pens may be used for production of high quality ink-on-paper plots of computer output data, with unvarying accuracy.

Completely digital, high-speed, high-resolution
plotting
On-line or off-line, fully automatic operation
Incremental speeds up to 450 steps/second, Zip
Mode speed up to 1687 steps/second (depending
on step size)
Full-step/half-step "electronic gear shift" for bet-
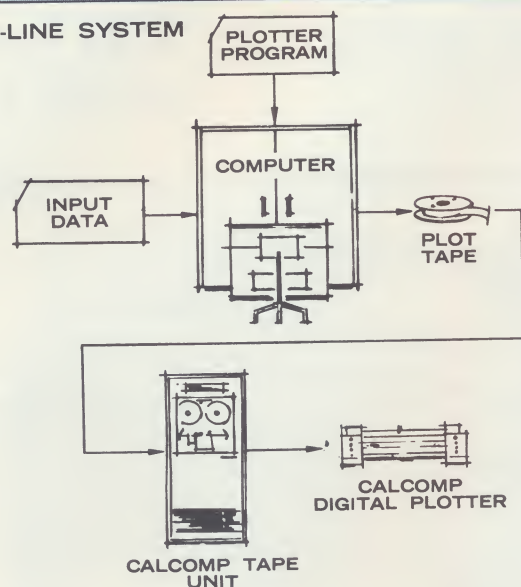ter accuracy and resolution
Optional step sizes
No paper alignment required
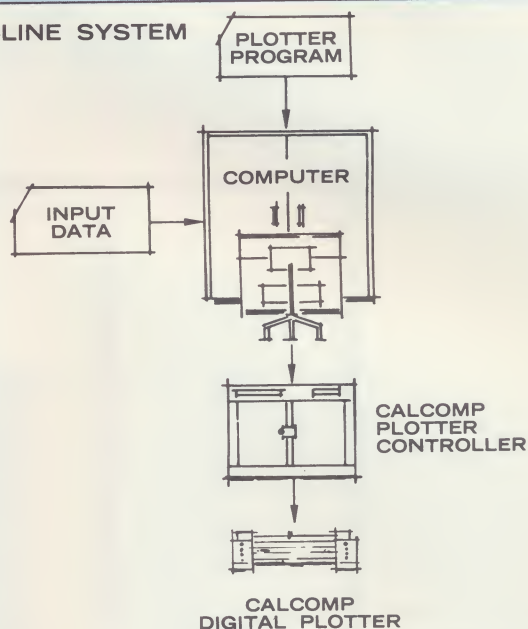Wide paper selection, plain or preprinted rolls



BASIC STEPS
700 SERIES INPUT



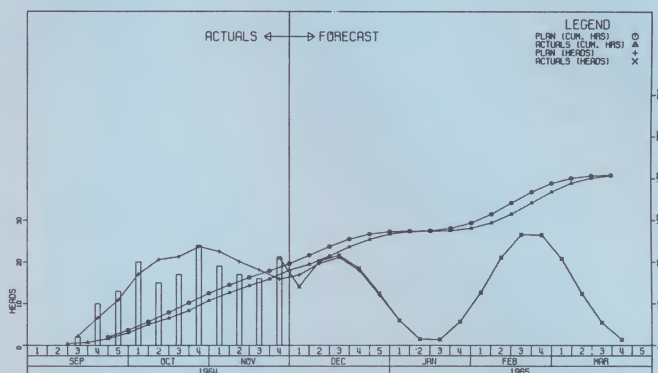OFF-LINE SYSTEM

ON-LINE SYSTEM

## PRINCIPLES OF OPERATION

All CalComp 700 series Digital Zip Mode® Plotters
operate on the same basic principle. Bidirectional step
motors are used for the X and Y axes and the plot is
produced by movement of a pen relative to the surface
of the recording paper. Coded input commands select
either incremental or Zip Mode operation. In the incre-
mental mode, each input plot command produces one
incremental step in the X or Y axis, or a combined X
and Y movement, in either the positive or negative direc-
tion. In addition, the command codes provide for either
full-step or half-step increments, or any X and Y axis
full-step/half-step intermix. These combinations provide
a total of 24 basic plot steps, as shown in the diagram.
Additional command codes are used to raise or lower
the recording pen. In the Zip Mode, each input plot

command represents a velocity increment and causes an
increase or decrease in speed relative to either axis, or
both axes. Maximum speed in the Zip Mode is 3.75 times
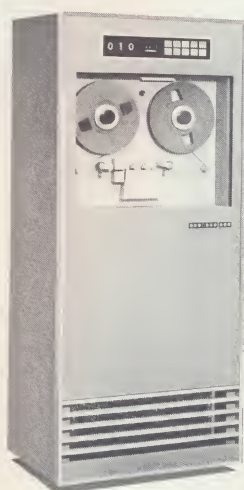the maximum incremental speed.

In the drum type plotters (Model 765 and 763), Y-axis
commands cause the pen carriage to move left or right
and X-axis commands cause the drum to move upward
or downward. The incremental step size is determined
by the gearing in the plotter, and several options are
available. Maximum incremental and Zip Mode rates
are dependent on the model and step size. Manual con-
trols are provided on the plotter for positioning the drum
and pen carriage, and for raising and lowering the pen.

When the digital plotter is used in an off-line system,

Manloading chart for a major development program—one of hundreds of applications for CalComp digital incremental plotters.

**OFF-LINE TAPE UNIT**



**ON-LINE PLOTTER CONTROLLER**



the plot data and associated control commands are pre-recorded on magnetic tape. The tape is then played back on a CalComp magnetic tape unit. The tape unit includes control logic circuits which locate the plot data on the tape, and supply the X and Y axis drive signals, mode selection signals, and the pen-up or pen-down (Z-axis) commands to the plotter.

When the plotter is used in an on-line system, the plot data and control commands are supplied directly to the plotter through a CalComp Plotter Controller.

## ON-LINE OPTIONS

CalComp also offers a selection of Plotter Controllers for on-line digital plotting with the 700 series plotters.

These units include a number of operator convenience features and options for increased computer efficiency and plotting flexibility. For detailed information, contact "CalComp Marketing" or your local Sales Representative.
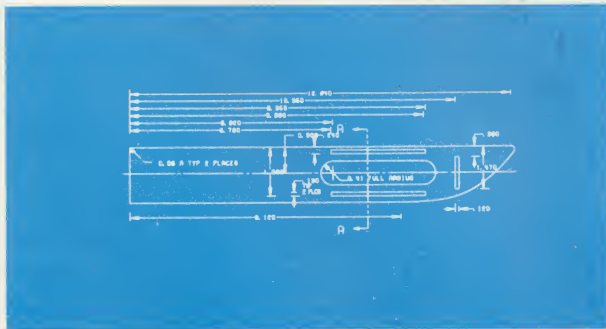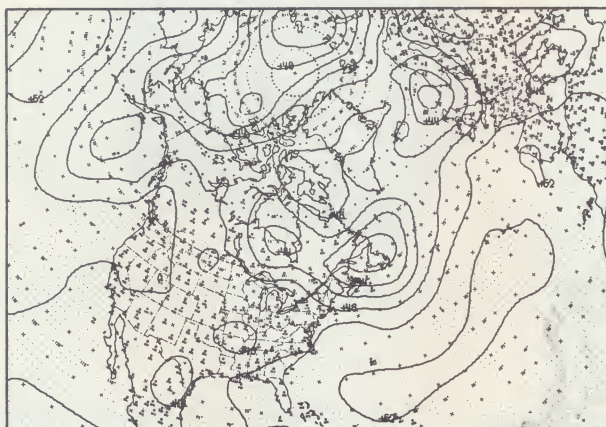
## OFF-LINE OPTIONS

The CalComp product line includes two Magnetic Tape Plotting systems for off-line digital plotting with the 700 series Digital Zip Mode plotters. The *Model 770* system incorporates a number of special features for ease of tape handling and plotting flexibility. (See Bulletin No. 192.) The *Model 780* includes all features of the Model 770 plus the capability for reading higher density tapes. (See Bulletin No. 193.)

# SPECIFICATIONS

| | | Model 765 | Model 763 | Model 702 | Model 718 |
|---|---|---|---|---|---|
| Type | | Drum | Drum | Flatbed | Flatbed |
| Maximum plot size: Y-axis | | 11″ | 29½″ | 31″ | 54″ |
| X-axis | | 120′ | 120′ | 34″ | 72″ |
| Incremental step size options (full-step/ half-step) | (1)<br>(2)<br>(3)<br>(4) | .010/.005″<br>.005/.0025″<br>.0025/.00125″<br>— | .010/005″<br>.005/.0025″<br>.0025/.00125″<br>— | .005/.0025″<br>.002/.001″<br>.1/.05 mm<br>.05/.025 mm | .002/.001″<br>.05/.025 mm<br>—<br>— |
| Max. incremental speed (vs. step size) in steps/second | (1)<br>(2)<br>(3)<br>(4) | 450<br>450<br>450<br>— | 350<br>450<br>450<br>— | 450<br>450<br>450<br>450 | 450<br>450<br>—<br>— |
| Max. Zip Mode speed (vs. step size) in steps/second | (1)<br>(2)<br>(3)<br>(4) | 1687<br>1687<br>1687<br>— | 1312<br>1687<br>1687<br>— | 1687<br>1687<br>1687<br>1687 | 1687<br>1687<br>—<br>— |
| Inputs | | Binary-coded five-bit command signals at logic levels of 0 volts (false) and +8 volts (true); clock pulses at nominal incremental speed; plot enable signal at 0 volts (false) and +8 volts (true) | | | |
| Power requirements (Models 765 and 763 only. For Flatbeds, see Bulletins 200, 201) | | 115 vac ± 10%, single phase, 60 cps, also available to operate at other voltages and frequencies. | | | |





## APPLICATIONS

The applications for CalComp digital plotting systems are as numerous and varied as the applications for the computers they complement. In every branch of government, in every scientific field, in industry and business, CalComp digital plotters and plotting systems have proved their accuracy, reliability, and efficiency. *Any* computer output data that can be reduced to graphic form manually can be automatically plotted on CalComp equipment — faster, with greater precision, and usually at lower cost.

## SOFTWARE SUPPORT

CalComp's staff of skilled programmers has one basic assignment: to provide our customers with the most comprehensive software support possible. This has always been a CalComp policy, because we know that it is good business — and that in the computer world, quality software is just as important as quality hardware. One important result of this policy: CalComp customers are able to put their plotting system to work as soon as it is delivered. And, equally important, they find that digital plotting is an easy task.

CALIFORNIA COMPUTER PRODUCTS, INC.
305 North Muller Street      Anaheim, California 92803
Phone (714) 774-9141      TWX 910-591-1154
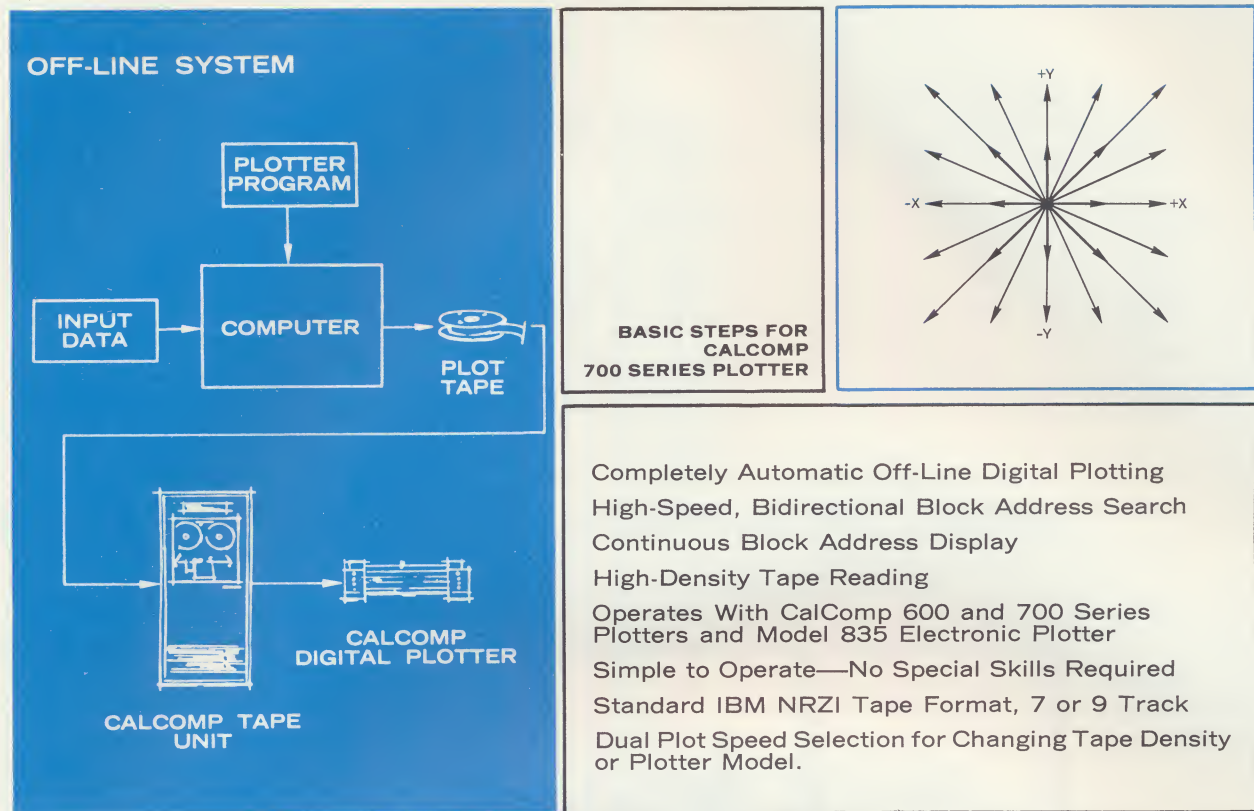
*780*

# MODEL 780 MAGNETIC TAPE PLOTTING SYSTEM

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**CALCOMP MODEL 780**
**WITH MODEL 765 PLOTTER**

The CalComp Model 780 is a magnetic tape unit for versatile, completely automatic, high-speed digital plotting, one of four magnetic tape units in the 700 series. Designed for off-line operation with virtually any medium or large-scale digital computer, the Model 780 is compatible with all CalComp Digital Incremental 600 Series Plotters and Digital Zip Mode® 700 Series Plotters, and with the new Model 835 Electronic Digital Plotter. The precision-engineered tape transport and logic circuitry provide all the advantages of off-line digital plotting and include a number of special features for maximum plotting flexibility.

OFF-LINE SYSTEM

PLOTTER PROGRAM

INPUT DATA → COMPUTER → PLOT TAPE

CALCOMP TAPE UNIT

CALCOMP DIGITAL PLOTTER

BASIC STEPS FOR CALCOMP 700 SERIES PLOTTER

Completely Automatic Off-Line Digital Plotting

High-Speed, Bidirectional Block Address Search

Continuous Block Address Display

High-Density Tape Reading

Operates With CalComp 600 and 700 Series Plotters and Model 835 Electronic Plotter

Simple to Operate—No Special Skills Required

Standard IBM NRZI Tape Format, 7 or 9 Track

Dual Plot Speed Selection for Changing Tape Density or Plotter Model.

## SYSTEM OPERATION

The Model 780 Magnetic Tape Plotting Unit utilizes seven tracks of a standard IBM-format 7 or 9 track ½-tape to provide automatic search and recognition of pre-selected block address codes, and to supply input commands to a CalComp Digital Plotter. The system is capable of operating at tape densities of 200, 556 or 800 bits-per-inch. A dual tape selector switch, a special feature of Model 780, offers a choice of options of tape densities or plotter speeds.
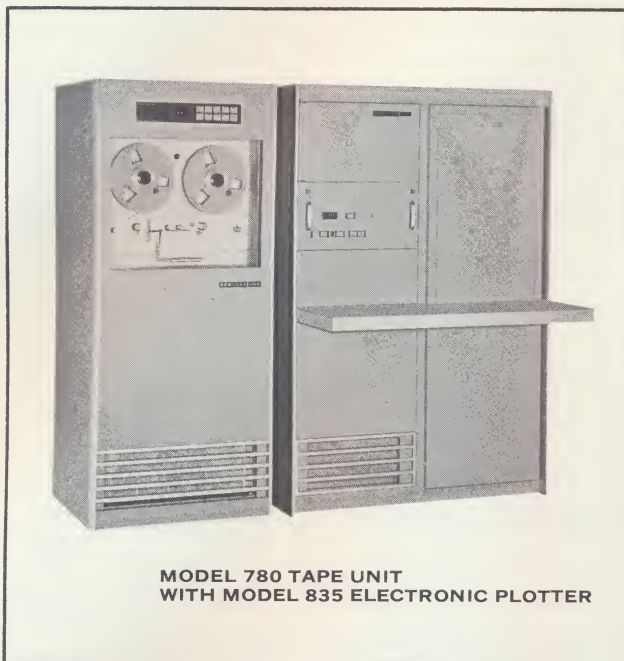
When using 7-track tape, there is a choice of:

1) Dual Tape Density (full or half density) and Single Plotter Speed; or

2) Single Tape Density and Dual Plotter Speed.

If the latter option is used, the Model 780 can drive either of two different plotters, even though their incremental speed rates may differ. With 9-track tape, the dual speed selector permits the use of either of two plotters as with 7-track tape, but the unit operates only at 800 bpi, half density. Model 780 has the capability for reading either 556 bpi tapes at full density or 800 bpi tapes at half density. The unit operates with Model 835 Electronic Digital Plotter as well as both the 600 and 700 series Digital Plotters.
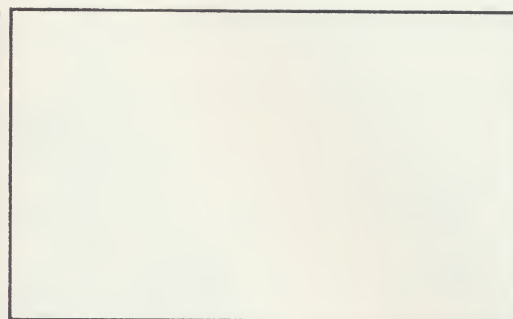
The 600 and 700 series plotters for which the unit is designed provide for higher speed incremental operation compared to the 500 series, plus the exclusive Zip Mode® feature of the 700 series which provides for plotting of smooth curves and straight lines at nearly four times the incremental speed.

Zip Mode plotting also provides a saving in magnetic tape. Another feature of the 600 and 700 series plotters is the provision for either full-step or half-step operation, or any intermix of the two in the X and Y axes, to provide a total of 24 basic plot steps, as shown in the accompanying diagram. A single-character code is used for each plot command for the various control commands.

The Model 780 and all tape units in the CalComp 700 series include a number of special features for ease of tape handling and plotting flexibility. The block address of the data to be plotted is preset by means of a three-digit thumbwheel switch. Either forward or reverse search mode may be used, and the transport automatically changes direction after the first block address is read from the tape if the tape is traveling in the wrong direction. The tape speed during search mode is 60 inches-per-second. The transport stops and a PLOT READY indicator lights when the selected block address has been found. Either single or multiple plot mode may then be selected. For multiple plot mode, the thumbwheel switch is reset to the block address following the last data to be plotted. The unit then automatically plots all data in sequence until that block address is read from the tape. Other features include a tape lifter which holds the tape clear of the read head during fast forward and rewind operations and during tape loading. Magnetic-particle brakes on the reel motors provide fast starting and stopping and eliminate mechanical wear. The transport uses standard 10½ inch tape reels.

**MODEL 780 TAPE UNIT
WITH MODEL 835 ELECTRONIC PLOTTER**



**MODEL 765
DIGITAL ZIP MODE® PLOTTER**

## PLOTTER OPTIONS

All 600 and 700 series CalComp plotters are compatible with the Magnetic Tape Plotting Unit described in this Bulletin. The Model 835 Electronic Digital Plotter is also compatible with the unit.

## 600 SERIES

The CalComp 600 series includes two drum types — the Model 665 with a plotting area of 11 inches (Y-axis) by 120 feet (X-axis); and Model 663 with a plotting area of 29½ inches by 120 feet. Both are compatible with the 700 series and operate in either full-step or half-step mode, with a maximum incremental rate of 900 steps-per-second. (See Bulletins No. 209, 210.)

## 700 SERIES

The 700 series includes two drum types and two flatbed types. The drum plotters are Model 765 (plotting area of 11 inches by 120 feet) and 763 (plotting area of 29½ inches by 120 feet). Maximum incremental speed is 450 steps-per-second. In the Zip Mode, the speed is 3.75 times the maximum incremental rate, or 1687 steps/second. The 700 series

also features the "electronic gear-shift" which permits either full-step or half-step operation, or a combination of the two, for improved resolution. (See Bulletins No. 196, 197.)

Two flatbed types are available in the 700 series. The Model 702 has a plotting area of 31 by 34 inches, and an incremental rate of 450 steps-per-second. A choice of four incremental step sizes is available. The Model 718 has a plotting area of 54 by 72 inches with maximum incremental step rate of 450 steps-per-second and maximum Zip Mode speed of 1687 steps-per-second. (See Bulletins No. 200, 201.)

## 800 SERIES

The CalComp Model 835 is an ultra-high-speed, all electronic digital incremental plotter which provides automatic recording of a cathode ray tube plot display on 35mm microfilm. When used with a 700 Series Magnetic Tape Plotting Unit, the Model 835 is capable of plotting all data on a 2400-foot reel of tape in 8 minutes. Maximum plotting speed, with 556 bpi tape, is 33,000 steps-per-second. Plot area, with optimum 15x magnification of microfilm image, is 11 by 17 inches. The Model 835 step size (when magnified 15x) is .005 inches. (See Bulletin No. 188.)

# SPECIFICATIONS

| | Model 470 | Model 750 | Model 760 | Model 770 | Model 780 |
|---|---|---|---|---|---|
| Operates with CalComp Digital Plotter series | 500 | 500, 600 | 500, 600, 835 | 600, 700, 835 | 600, 700, 835 |
| Plot commands per inch of tape at 200 bpi | 67 | 67 | 200 | 200 | 200 |
| 556 bpi | 93 | 93 | 278 | 278 | 556 |
| 800 bpi | 89 | 89 | 267 | 267 | 400 |
| Maximum inches of plot per inch of tape | 1.3 | 1.3 | 3.9 | 14.7 | 29.4 |
| Block address display and automatic search | No | Yes | Yes | Yes | Yes |
| Search speed (in/sec) | 4½ | 60 | 60 | 60 | 60 |
| Tape reel size (max. in.) | 8½ | 10½ | 10½ | 10½ | 10½ |
| Tape lifter for fast forward and rewind | No | Yes | Yes | Yes | Yes |
| Tape speed control switch for change of tape density or plotter model | No | Yes | Yes | Yes | Yes |
| Max. power requirement (watts) | 500 | 800 | 800 | 1400 | 1400 |





## APPLICATIONS

The applications for CalComp digital plotting systems are as numerous and varied as the applications for the computers they complement. In every branch of government, in every scientific field, in industry and business, CalComp digital plotters and plotting systems have proved their accuracy, reliability, and efficiency. *Any* computer output data that can be reduced to graphic form manually can be automatically plotted on CalComp equipment—faster, with greater precision, and usually at lower cost.
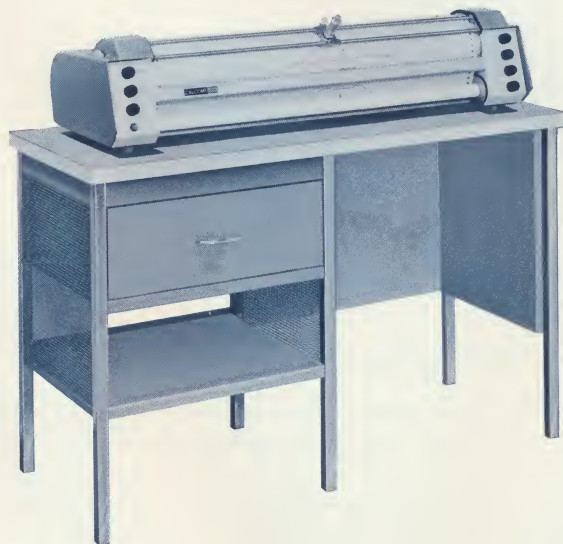
## SOFTWARE SUPPORT

CalComp's staff of skilled programmers has one basic assignment: to provide our customers with the most comprehensive software support possible. This has always been a CalComp policy, because we know that it is good business—and that in the computer world, quality software is just as important as quality hardware. One important result of this policy: CalComp customers are able to put their plotting system to work as soon as it is delivered. And, equally important, they find that digital plotting is an easy task.

CALIFORNIA COMPUTER PRODUCTS, INC.
305 North Muller Street     Anaheim, California 92803
Phone (714) 774-9141     TWX 910-591-1154

*563*

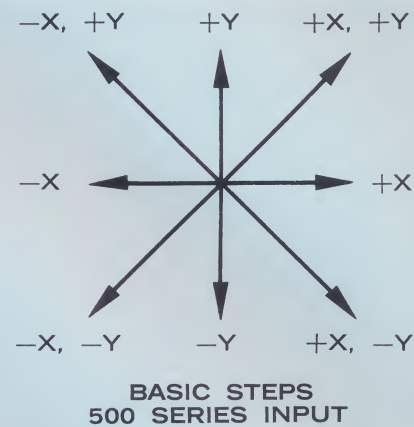# MODEL 563 DIGITAL INCREMENTAL PLOTTER
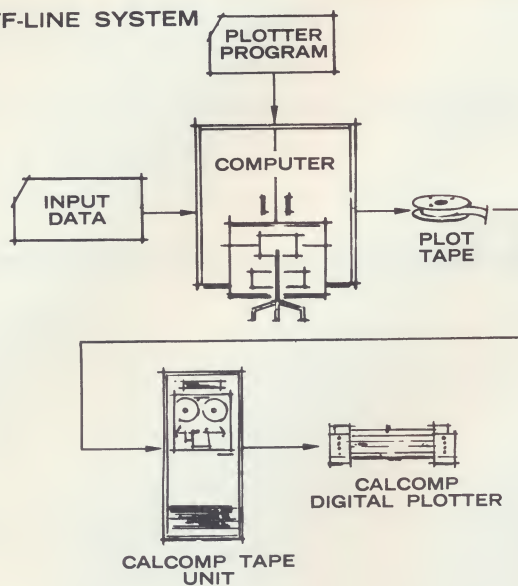# DRUM TYPE

C A L C O M P



The CalComp Model 563 is one of several models in the 500 series, suitable for automatic digital plotting with virtually any standard computer—on-line or off-line. The unit is simple to operate, and has a large effective plotting area—29½ inches by 120 feet. Either ballpoint or liquid ink pens may be used for production of high quality ink-on-paper plots of computer output data, with unvarying accuracy.
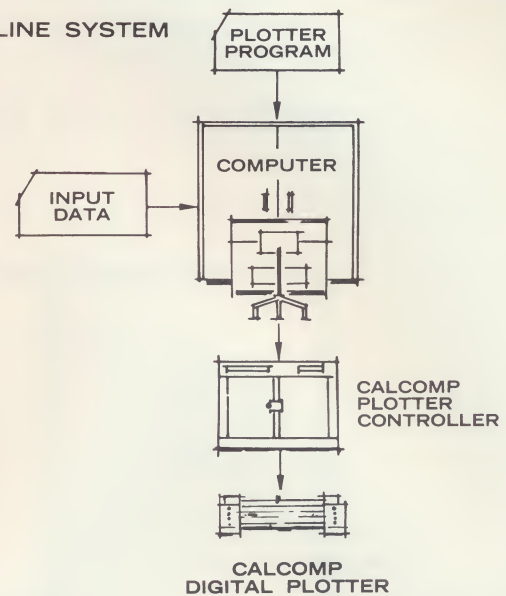
Completely digital, high-resolution plotting, on-line or off-line
Incremental rate up to 300 steps-per-second
Optional step size
Fully automatic, unattended operation
No paper alignment required
Wide paper selection, plain or preprinted rolls

```
        −X, +Y        +Y        +X, +Y


    −X                                    +X


        −X, −Y        −Y        +X, −Y
```

**BASIC STEPS
500 SERIES INPUT**

**OFF-LINE SYSTEM**

PLOTTER PROGRAM

COMPUTER

INPUT DATA

PLOT TAPE

CALCOMP TAPE UNIT

CALCOMP DIGITAL PLOTTER

**ON-LINE SYSTEM**

PLOTTER PROGRAM

COMPUTER

INPUT DATA

CALCOMP PLOTTER CONTROLLER

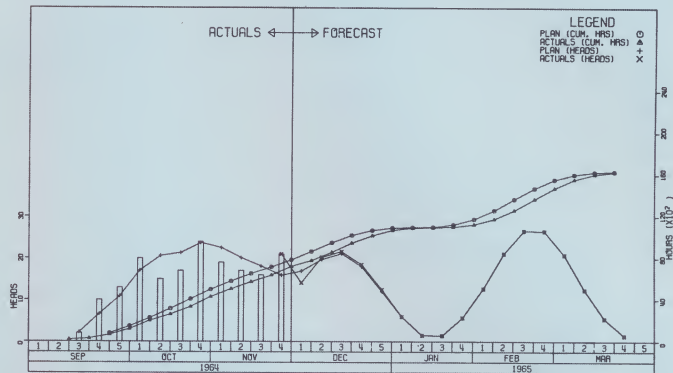CALCOMP DIGITAL PLOTTER

## PRINCIPLES OF OPERATION

All CalComp 500 series Digital Incremental Plotters operate on the same basic principle. Bidirectional step motors are used for the X and Y axes and the plot is produced by movement of a pen relative to the surface of the recording paper. Each input command produces one incremental step in the X or Y axis, or a combined X and Y movement, in either the positive or negative direction. (See diagram.) Additional commands are used to raise or lower the recording pen. In the drum type plotters (Model 563 and 565), a Y-axis command causes the pen carriage to move one step to the left or right, and an X-axis command causes the drum to move one step upward or downward. The incremental step size is determined by the gearing in the plotter, and several options are available. The incremental rate is either 200 or 300 steps-per-second, depending on the

model and step size. Manual controls are provided on the plotter for positioning the drum and pen carriage, and for raising and lowering the pen.

When the digital plotter is used in an off-line system, the plot data and associated control commands are pre-recorded on magnetic tape. The tape is then played back on a CalComp magnetic tape unit. The tape unit includes control logic circuits which locate the plot data on the tape, and decoding circuits which supply the X and Y axis drive signals to the plotter, and the pen-up or pen-down (Z-axis) commands.

When the plotter is used in an on-line system, the plot data and control commands are supplied directly to the plotter through a CalComp Plotter Controller or adapter, or through interface electronics supplied by the computer manufacturer.

Manloading chart for a major development
program—one of hundreds of applications
for CalComp digital incremental plotters.

**OFF-LINE TAPE UNIT**



**ON-LINE PLOTTER CONTROLLER**



## OFF-LINE OPTIONS

The CalComp product line includes three Magnetic Tape
Plotting systems for off-line digital plotting with the 500
series Digital Incremental Plotters.

### Model 470
Provides a compact off-line system at minimum cost.
(See Bulletin No. 189.)

### Model 750
Provides special features for greater ease of tape han-
dling and plotting flexibility. (See Bulletin No. 190.)

### Model 760
Includes special features of Model 750, plus a tape for-
mat which reduces significantly the computer time and
the amount of tape required for plotting. (See Bulletin
No. 191.)

### Model 471
### Automatic Tracer/Digitizer

Precisely follows continuous graphic data — curves, pro-
files, outlines — and converts this analog data to digital
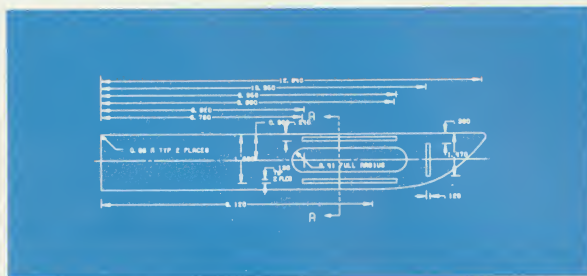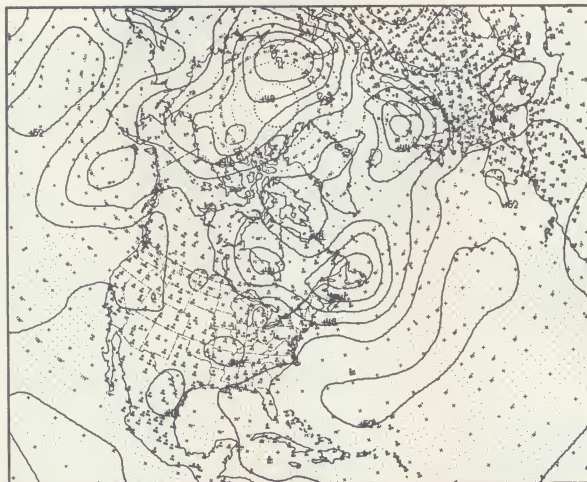increments and records it on magnetic tape. (See Bulle-
tin No. 176.)

## ON-LINE OPTIONS

CalComp offers a wide range of interface equipment for
on-line digital plotting with 500 series plotters and most
standard digital computers. These include the Model 100
Plotter Buffer (Bulletin No. 138), a series of Plotter
Controllers with optional core buffer, and several Plotter
Adapters. For detailed information, contact "CalComp
Marketing" or your local Sales Representative.

# SPECIFICATIONS

| | | Model 565 | Model 563 | Model 502 | Model 518 |
|---|---|---|---|---|---|
| Type | | Drum | Drum | Flatbed | Flatbed |
| Maximum plot size: Y-axis | | 11″ | 29½″ | 31″ | 54″ |
| X-axis | | 120′ | 120′ | 34″ | 72″ |
| Incremental step size options | (1) | .010″ | .010″ | .010″ | .005″ |
| | (2) | .005″ | .005″ | .005″ | .002″ |
| | (3) | 0.1 mm | 0.1 mm | .002″ | 0.1 mm |
| | (4) | — | — | 0.1 mm | — |
| | (5) | | | 0.05 mm | 0.05 mm |
| Max. incremental speed (vs. step size) in steps/second | (1) | 300 | 200 | 300 | 200 |
| | (2) | 300 | 300 | 300 | 450 |
| | (3) | 300 | 300 | 300 | 200 |
| | (4) | — | — | 300 | — |
| | (5) | | | 300 | 400 |
| Inputs (Models 565 and 563 only; for Flatbeds, see Bulletins 198, 199) | | Positive or negative polarity pulses, amplitude greater than 10V, rise time less than 10 μsec, minimum pulse width 4 μsec, source impedance less than 500 ohms | | | |
| Power requirements | | 105 to 125 vac, single phase, 50/60 Hz, 1.5 amp. at 115 vac | | | |





## APPLICATIONS

The applications for CalComp digital plotting systems are as numerous and varied as the applications for the computers they complement. In every branch of government, in every scientific field, in industry and business, CalComp digital plotters and plotting systems have proved their accuracy, reliability, and efficiency. *Any* computer output data that can be reduced to graphic form manually can be automatically plotted on CalComp equipment—faster, with greater precision, and usually at lower cost.

## SOFTWARE SUPPORT

CalComp's staff of skilled programmers has one basic assignment: to provide our customers with the most comprehensive software support possible. This has always been a CalComp policy, because we know that it is good business—and that in the computer world, quality software is just as important as quality hardware. One important result of this policy: CalComp customers are able to put their plotting system to work as soon as it is delivered. And, equally important, they find that digital plotting is an easy task.
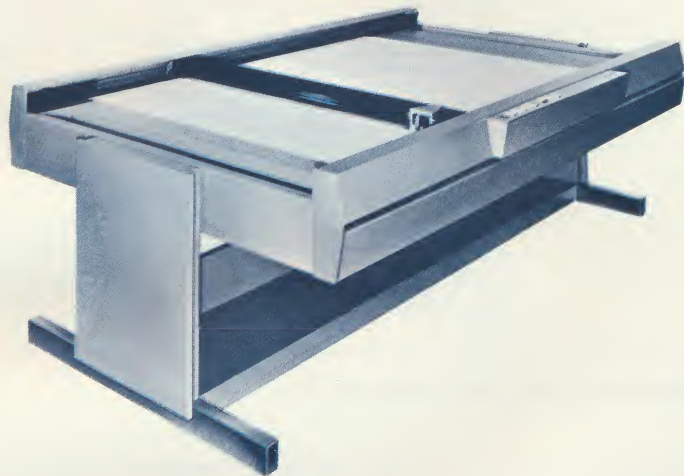
CALIFORNIA COMPUTER PRODUCTS, INC.
305 North Muller Street    Anaheim, California 92803
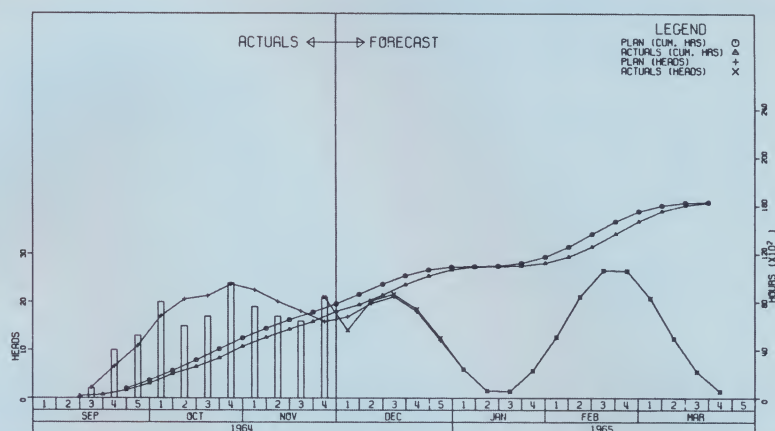Phone (714) 774-9141    TWX 910-591-1154

718

*PRELIMINARY PRODUCT NOTE*

# MODEL 718  DIGITAL ZIP MODE® PLOTTER
# FLAT BED TYPE

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The CalComp Model 718 is one of several models available in the Zip Mode® 700 series, suitable for automatic digital plotting with virtually any standard computer, on-line or off-line. The exclusive CalComp Zip Mode, a feature of all 700 series plotters, provides very high-speed plotting of smooth curves and straight lines. The "electronic gear shift", another CalComp exclusive, provides full-step/half-step intermix for improved resolution. The large, flat plotting surface, 54 x 72 inches, is especially suited to on-line operations where real-time graphic output is required, and to automatic drafting applications. Either ballpoint or liquid ink pens may be used for production of high quality plots of computer output data, with unvarying accuracy.

Manloading chart for a major development program—one of hundreds of applications for CalComp digital incremental plotters.

**OFF-LINE TAPE UNIT**
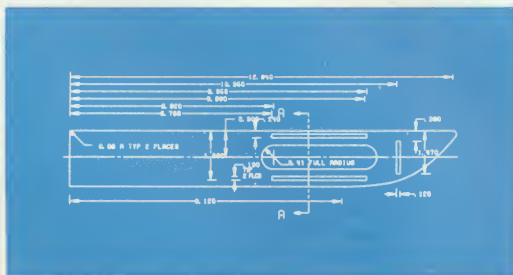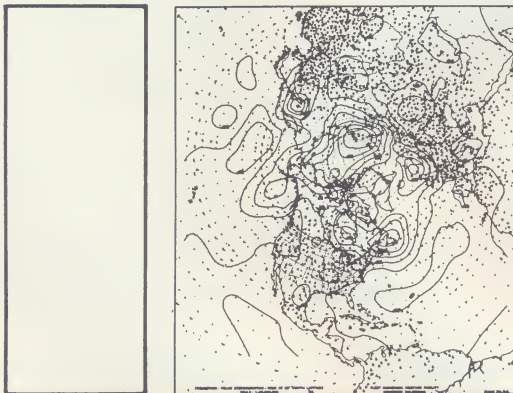
**ON-LINE PLOTTER CONTROLLER**

## OFF-LINE OPTIONS

The CalComp product line includes two magnetic tape plotting systems for off-line digital plotting with the 700 series Digital Zip Mode Plotters. The *Model 770* system incorporates a number of special features for ease of tape handling and plotting flexibility. (See Bulletin No. 192.) The *Model 780* includes all features of the Model 770 plus the capability for reading higher density tapes. (See Bulletin No. 193.)

## ON-LINE OPTIONS

CalComp also offers a selection of Plotter Controllers for on-line digital plotting with the 700 series plotters. These units include a number of operator convenience features and options for increased computer efficiency and plotting flexibility. For detailed information, contact "CalComp Marketing" or your local Sales Representative.

# SPECIFICATIONS

| | | Model 765 | Model 763 | Model 702 | Model 718 |
|---|---|---|---|---|---|
| Type | | Drum | Drum | Flatbed | Flatbed |
| Maximum plot size: Y-axis | | 11″ | 29½″ | 31″ | 54″ |
| X-axis | | 120′ | 120′ | 34″ | 72″ |
| Incremental step size options (full-step/ half-step) | (1) | .010/.005″ | .010/.005″ | .005/.0025″ | .002/.001″ |
| | (2) | .005/.0025″ | .005/.0025″ | .002/.001″ | .05/.025 mm |
| | (3) | .0025/.00125″ | .0025/.00125″ | .1/.05 mm | — |
| | (4) | — | — | .05/.025 mm | — |
| Max. incremental speed (vs. step size) in steps/second | (1) | 450 | 350 | 450 | 450 |
| | (2) | 450 | 450 | 450 | 450 |
| | (3) | 450 | 450 | 450 | — |
| | (4) | — | — | 450 | — |
| Max. Zip Mode speed (vs. step size) in steps/second | (1) | 1687 | 1312 | 1687 | 1687 |
| | (2) | 1687 | 1687 | 1687 | 1687 |
| | (3) | 1687 | 1687 | 1687 | — |
| | (4) | — | — | 1687 | — |
| | | Binary-coded five-bit command signals at logic levels of 0 volts false and +8 volts (true); clock pulses at nominal incremental speed; plot enable signal at 0 volts (false) and +8 volts (true) | | | |
| Power requirements (Models 702 and 718 only. For Drums see Bulletins 196, 197.) | | 115 vac ±10%, single phase, 60 cps, also available to operate at 208 or 230V, 50/60 Hz. | | | |





## APPLICATIONS

The applications for CalComp digital plotting systems are as numerous and varied as the applications for the computers they complement. In every branch of government, in every scientific field, in industry and business, CalComp digital plotters and plotting systems have proved their accuracy, reliability, and efficiency. *Any* computer output data that can be reduced to graphic form manually can be automatically plotted on CalComp equipment—faster, with greater precision, and usually at lower cost.

## SOFTWARE SUPPORT

CalComp's staff of skilled programmers has one basic assignment: to provide our customers with the most comprehensive software support possible. This has always been a CalComp policy, because we know that it is good business—and that in the computer world, quality software is just as important as quality hardware. One important result of this policy: CalComp customers are able to put their plotting system to work as soon as it is delivered. And, equally important, they find that digital plotting is an easy task.

CALIFORNIA COMPUTER PRODUCTS, INC.
305 North Muller Street    Anaheim, California 92803
'Phone (714) 774-9141    TWX 910-591-1154

*665*

*PRELIMINARY PRODUCT NOTE*

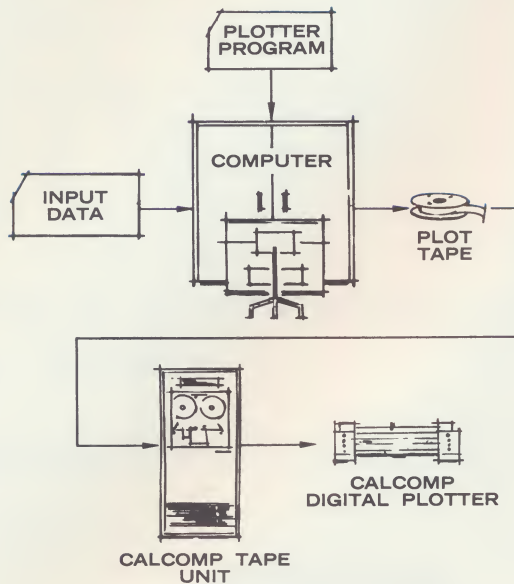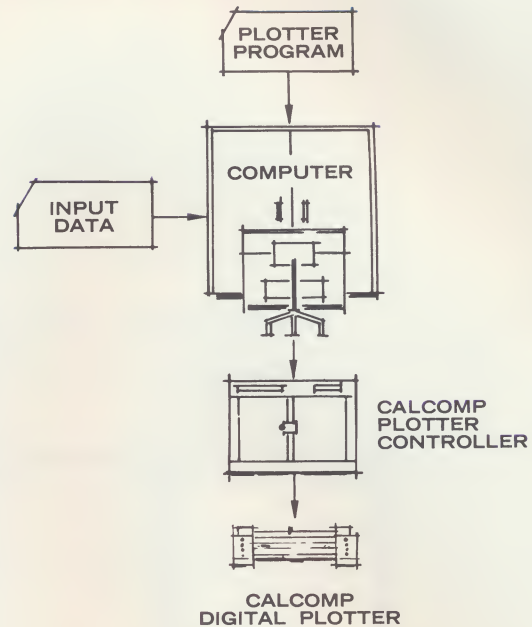# MODEL 665 DIGITAL INCREMENTAL PLOTTER
# DRUM TYPE

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*The CalComp 600 series gives you unmatched flexibility for meeting your present and future digital plotting needs; the 600's bring compatibility to the full CalComp line.*

The CalComp Model 665 plots on-line with most CalComp interface units and off-line with magnetic tape unit Models 750, 760, 770 and 780. Model 665 is program-compatible with plotters in the Model 500 and 700 series, and has a maximum step-rate of 900 increments per second. With 500 series plotter input format, full-step or half-step increments are manually selectable; with 700 series input format, programmable full-step, half-step or full-step/half-step intermix provides smooth resolution.

OFF-LINE SYSTEM

PLOTTER PROGRAM

COMPUTER

INPUT DATA

PLOT TAPE

CALCOMP TAPE UNIT

CALCOMP DIGITAL PLOTTER

ON-LINE SYSTEM

PLOTTER PROGRAM

COMPUTER

INPUT DATA

CALCOMP PLOTTER CONTROLLER

CALCOMP DIGITAL PLOTTER

Program-compatible with CalComp 500 and 700 series plotters

Incremental rate up to 900 steps per second

Full-step/half-step ''electronic gear shift'' inter-mix or manual selection of full-step/half-step

Optional step size

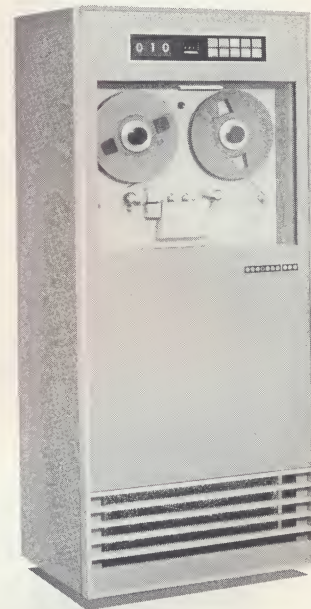Completely digital, high-resolution plotting

Fully automatic operation, on-line or off-line

Wide selection of plain or pre-printed paper
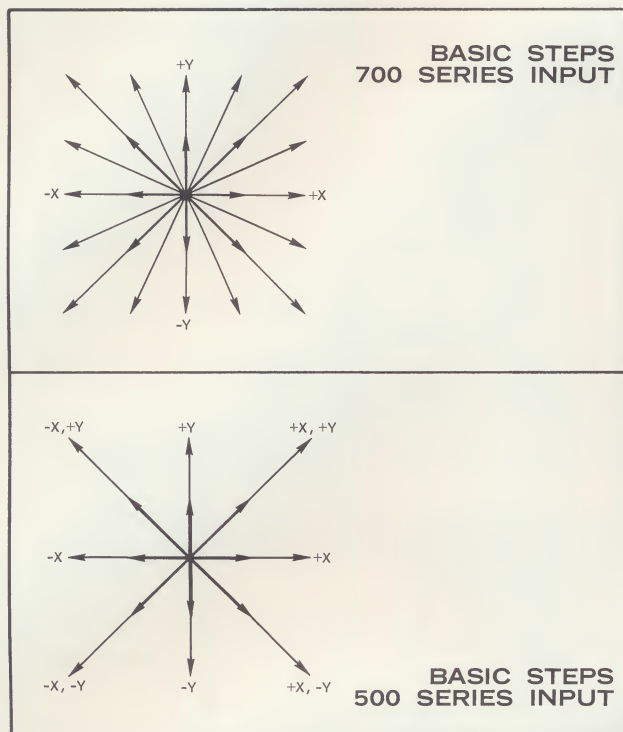
No paper alignment required



ON-LINE PLOTTER CONTROLLER



OFF-LINE TAPE UNIT

BASIC STEPS
700 SERIES INPUT



BASIC STEPS
500 SERIES INPUT

## PRINCIPLES OF OPERATION

CalComp 600 series digital plotters use bi-directional step motors for the X and Y axes and the plot is produced by the movement of the pen relative to the surface of the recording paper.

Two basic step patterns are utilized (see diagrams) because 600 series plotters accept both the 500 series input format and the 700 series input format. When using the 500 series input, the operator uses a manual switch to select full-step or half-step increments. Each input plot command produces one incremental movement in the X or Y axis, or a combined X and Y movement, either positively or negatively, in one of eight different directions. Half-steps provide a total of 16 basic plot steps. A Y axis command causes the pen carriage to move one increment to the left or right; an X axis command causes the drum to move one step up or down. Additional commands raise or lower the pen.

When the 700 series input format is used, coded input commands produce steps in the X or Y axis in 16 different step directions; half-steps provide a total of 24 basic plot steps, as shown in the diagram. Command codes provide full-step or half-step increments, or an intermix of full- and half-steps. Additional codes raise or lower the pen.

Manual controls on the plotter provide for positioning of the drum and pen carriage, and for raising and lowering the pen.

## OFF-LINE OPERATION

When the Model 665 digital plotter is used in an off-line system, the plot data and associated control commands are pre-recorded on magnetic tape. The tape is then played back on a CalComp magnetic tape unit. The tape unit includes control logic circuits which locate the plot data on the tape; decoding circuits supply operating commands to the plotter.

## OFF-LINE OPTIONS

CalComp's full line of magnetic tape systems provides complete off-line plotting capabilities for the 600 series of digital plotters.

### 500 SERIES INPUT

Model 750 — provides ease of tape handling and high plotting flexibility (see Bulletin #190).

Model 760 — all capabilities of the 750, plus tape format that increases plotting efficiency by reducing computer time and tape quantity (see Bulletin #191).

### 700 SERIES INPUT

Model 770 — essentially the same features as the 760, but with capability to handle the 700-series input format (see Bulletin #192).

Model 780 — all capabilities of the 770, with added ability to handle higher density tapes (see Bulletin #193).

## ON-LINE OPERATION

When the 665 plotter is used in an on-line computer system, the plot data and control commands are supplied directly to it through a CalComp Plotter controller or adapter, or through interface electronics supplied by the computer manufacturer.
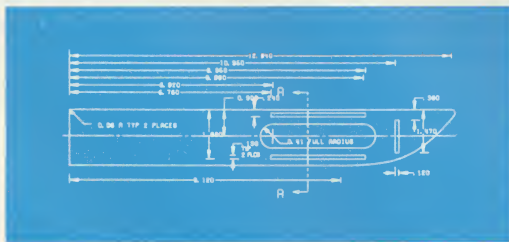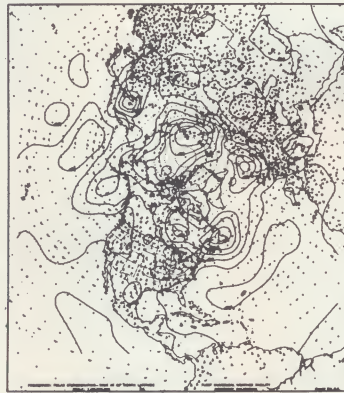
## ON-LINE OPTIONS

A wide range of CalComp interface units for use with the 665 plotter gives most standard computers high-speed on-line digital plotting capabilities. For detailed information, contact CalComp Marketing or your local sales representative.

## CALCOMP

*QUALITY STANDARD OF THE PLOTTING INDUSTRY*

# SPECIFICATIONS

| | | Model 665 | Model 663 |
|---|---|---|---|
| Type | | Drum | Drum |
| Maximum Plot Size | Y axis<br>X axis | 11"<br>120' | 29.5"<br>120' |
| Incremental step size options (full-step / half-step) | (1)<br>(2)<br>(3) | .010  /.005"<br>.005  /.0025"<br>.0025/.00125" | .010  /.005"<br>.005  /.0025"<br>.0025/.00125" |
| Maximum incremental speeds (vs. Step Size) in Steps/Second | (1)<br>(2)<br>(3) | 450/900<br>450/900<br>450/900 | 350/700<br>450/900<br>450/900 |
| Plotter Dimensions | D<br>W<br>H | 15.5"<br>20.6"<br>10.2" | 15.5"<br>40.12"<br>10.2" |
| Table Dimensions | D<br>W<br>H | 21"<br>48"<br>29" | 21"<br>48"<br>29" |
| Inputs     500 series<br>            format | | Positive or negative polarity pulses, amplitude greater than 10v, rise time less than 10 μsec, minimum pulse width 4 μsec, source impedance less than 500 ohms. | |
|          700 series<br>            format | | Binary-coded five-bit command signals at logic levels of 0 volts (false) and +8 volts (true); clock pulses at nominal incremental speed; plot enable signal at 0 volts (false) and +8 volts (true). | |
| Power Requirements | | Standard −115 vac ±10%, single phase, 60 Hz (Other voltages and frequencies available.) | |





## APPLICATIONS

CalComp digital plotting systems will automatically plot any computer output data that you can reduce to graphic form manually—faster, more accurately, and usually at lower cost. CalComp systems are in wide use with many different computer systems in business and industry, in scientific fields, and in government. They have proved their accuracy, reliability and efficiency.

## SOFTWARE

CalComp backs its hardware with a staff of skilled programmers who provide every aspect of quality software. As a result, you can put your system to work immediately when it is delivered, whether it be for on-line or off-line applications. Ask CalComp Marketing about its comprehensive programming services, ranging from indoctrination of your personnel all the way through the development of completely new applications.
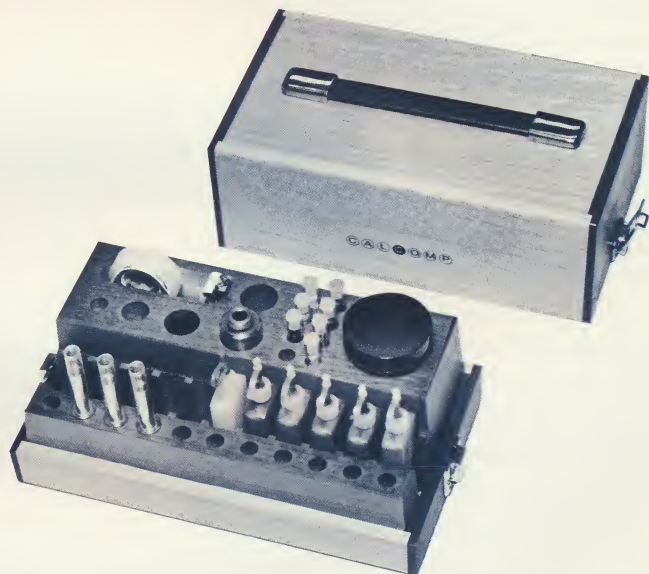
**FOR MORE INFORMATION ABOUT CALCOMP PRODUCTS AND SERVICES CONTACT "MARKETING" OR YOUR LOCAL SALES REPRESENTATIVE**

# LIQUID INK ACCESSORY KITS
# BALLPOINT PEN ACCESSORY KITS

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To match the versatility of its digital plotting systems, CalComp has available as optional accessories both Liquid Ink and Ballpoint Pen Accessory Kits particularly suited to the capabilities of each of its plotter series. The pen-and-ink accessories included in each of the kits are interchangeable with the compatible Liquid Ink/Ballpoint Pen Combination assemblies supplied as standard equipment with the plotters.

## PLOTTERS/KITS

| TYPE OF KIT | GENERAL PURPOSE | HIGH-SPEED |
|---|---|---|
| BALLPOINT | *10082-101 | 10082-101-11 |
| LIQUID INK | 20-300 | 10065-101 |
| COMBINATION | **10073-101 | **10070-101 |
|  | For use with Models 565, 563, 575, 502, 518, 718 — all step sizes . . . 702 — .002" — .05mm step sizes . . . 665, 663 — .005/.0025"— .0025/.00125" step sizes | For use with Models 765, 763 — all step sizes . . . 702 — .005" — .1mm step sizes . . . 665, 663 — .010/.005" step sizes . . . |

*Shipped with Models 565, 563, 575 as standard equipment.
**Shipped with other plotters as noted above as standard equipment.
Other kits available as accessories.

CalComp's pen-and-ink kits have been designed to match the specific plotting capabilities of each of its plotters. Different ink characteristics have been developed for general purpose and high-speed plotting.

Ink pens in varying sizes, from extra, extra fine to extra broad, can draw any type of computer output — from small annotation to charting. Ballpoint pens, too, are capable of drawing any graphic presentation, including maps, charts, lines, curves and graphs. Both liquid ink and ballpoint pens are available in a variety of colors.

All CalComp plotters are shipped with combination Liquid Ink/Ballpoint Pen Kits (with the exception of Models 565, 563 and 575 — which are shipped with a Ballpoint Pen Kit only).

Components in the combination pen kits are interchangeable with those in corresponding Liquid Ink or Ballpoint Pen Kits which CalComp offers as accessories. All liquid ink assemblies are interchangeable with ballpoint pen assemblies.

### DESCRIPTION
The Cap Adjustment Assembly of the Liquid Ink pen adjusts the pen travel and contains a spring-loaded pin which engages a flange on the Plunger Assembly to keep the pen from rotating. The Ink Cartridge holds the ink supply, and assembles to the Plunger Assembly by locking the Cartridge Retainer.

With both Liquid Ink and Ballpoint pens, the Plunger Assembly holds and moves the Drawing Pen in the pen-up and pen-down axis. The solenoid electrical drive to the pen is contained in the Pen Holder, which is supplied as standard equipment with the plotter.

Components of each of the Liquid Ink and Ballpoint Pen Accessory Kits are packed in a handy, hardwood case custom-fitted for convenience in storing parts. Additional storage is provided for standard accessories such as reticles, extra pens, pen holder and extra points.

Accessories such as Liquid Ink Conversion Assemblies, Liquid Ink Drawing Pens, Drawing Inks, Pen Cleaner, Ballpoint Pens, Reticles and Carrying Case may be ordered from CalComp as individual replacement parts.

Operation and service instructions are packed inside each kit.

## PEN-AND-INK COMPONENTS

| BALLPOINT COMPONENTS | PART NO. | LIQUID INK ACCESSORY KIT 20-300 | LIQUID INK ACCESSORY KIT 10065-101 | BALLPOINT ACCESSORY KIT 10082-101 | BALLPOINT ACCESSORY KIT 10082-101-11 | COMBINATION KIT 10070-101 | COMBINATION KIT 10073-101 |
|---|---|---|---|---|---|---|---|
| Large Reticle | 20-168 | | | 1 | 1 | 1 | 1 |
| Small Reticle | 20-169 | | | 1 | 1 | 1 | |
| Plunger Assembly | 20-079 | | | 1 | 1 | 1 | 1 |
| Cap Assembly | 20-118 | | | 1 | 1 | 1 | 1 |
| Body Assembly | 11631-203 | | | 1 | 1 | 1 | 1 |
| Ballpoint Pen .1mm Green (715) | B60-40C | | | 2 | 2 | 2 | 2 |
| Ballpoint Pen .1mm Blue (716) | B60-40C | | | 2 | 2 | 2 | 2 |
| Ballpoint Pen .1mm Black (719) | B60-40C | | | 2 | 2 | 2 | 2 |
| Ballpoint Pen .1mm Red (706) | B60-40C | | | 2 | 2 | 2 | 2 |
| **LIQUID INK COMPONENTS** | | | | | | | |
| Cap Adjustment Assembly | 10004-301 | 1 | 1 | | | 1 | 1 |
| Plunger Assembly | 10005-301 | 3 | 3 | | | 3 | 3 |
| Ink Cartridge | 88 | 3 | 3 | | | 3 | 3 |
| Retainer Cartridge | 10336-203 | 3 | 3 | | | 3 | 3 |
| Vial (Storage Cover) | 10364-203 | 3 | 3 | | | 3 | 3 |
| **GENERAL PURPOSE PENS AND INKS** | | | | | | | |
| ¾ oz. Black Ink | 11663-203-1 | 1 | | | | | 1 |
| ¾ oz. Blue Ink | 11663-203-2 | 1 | | | | | 1 |
| ¾ oz. Red Ink | 11663-203-3 | 1 | | | | | 1 |
| ¾ oz. Green Ink | 11663-203-4 | 1 | | | | | 1 |
| ¾ oz. Brown Ink | 11663-203-5 | 1 | | | | | 1 |
| Extra, Extra Fine Liquid Ink Pen | 11664-203-21 | 1 | | | | | 1 |
| Extra Fine Liquid Ink Pen | 11664-203-31 | 1 | | | | | 1 |
| Fine Liquid Ink Pen | 11664-203-41 | 1 | | | | | 1 |
| Medium Liquid Ink Pen | 11664-203-51 | 1 | | | | | 1 |
| Medium Broad Liquid Ink Pen | 11664-203-61 | 1 | | | | | 1 |
| Broad Liquid Ink Pen | 11664-203-81 | 1 | | | | | 1 |
| Extra Broad Liquid Ink Pen | 11664-203-101 | 1 | | | | | |
| **HIGH-SPEED PENS AND INKS** | | | | | | | |
| ¾ oz. Black Ink | 11558-203-1 | | 1 | | | 1 | |
| ¾ oz. Blue Ink | 11558-203-2 | | 1 | | | 1 | |
| ¾ oz. Red Ink | 11558-203-3 | | 1 | | | 1 | |
| ¾ oz. Green Ink | 11558-203-4 | | 1 | | | 1 | |
| Extra, Extra Fine Liquid Ink Pen | 11559-203-11 | | 4 | | | 4 | |
| Extra Fine Liquid Ink Pen | 11559-203-21 | | 4 | | | 4 | |
| Pen Cleaner (Dispenser) | 3065-F | 1 | 1 | | | 1 | 1 |
| "Rapido-eze" Cleaner (Jar) | 3068 | 1 | 1 | | | 1 | 1 |
| Magic Tape (½" x 400") | 104 | 1 | 1 | 1 | 1 | 1 | 1 |
| Carrying Case | 20-149 | | | 1 | 1 | | |
| Carrying Case | 10002-201 | 1 | 1 | | | 1 | 1 |

*110*

# MODEL 110 PLOTTER CONTROLLER
# FOR IBM SYSTEM/360

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CALCOMP MODEL 110
WITH MODEL 765
DIGITAL ZIP MODE PLOTTER

## DESIGN FEATURES

Modular electronic design provides for convenient and inexpensive upgrading.

Cabinet can be expanded to include electronics for 600 and 700 series plotters.

Sense switches provide extra operator convenience and improved plotting efficiency.

Compatible for on-line operation with all CalComp digital incremental plotters.

Optional core buffers for improved efficiency.

Optional dual channel feature for multiple plotter operation.

Tie-in with System/360 power control interface.

# SYSTEM OPERATION

## Basic Model 110

The basic Model 110 with single-character buffer connects to and operates with the Multiplexor channel via an I/O interface section. (Operation on the Selector channel is not recommended except with one of the core buffer options.) The I/O interface consists of byte-buses for commands, addresses, data, or status and channel interlock controls. The interlocks establish priorities among the other control units attached to the I/O channel.

Operation is initiated by a program command given by the channel and accepted by the Model 110. The unit cannot be addressed again until it has presented the terminating status to the channel.

Operation with the basic Model 110 on the Multiplexor channel is normally in the "byte" mode. ("Burst" mode operation is normally used only with one of the core buffer options.) In the byte mode the Model 110 releases the I/O channel after initial selection, after transferring each byte of data, and prior to presenting the terminating status.

Three I/O instructions are used to operate the 110: start I/O, test I/O, and halt I/O. CalComp supplies programming routines to execute the I/O operations. When a plot is to be performed, a CalComp routine prepares a list of channel command words (CCW) in main storage. The CCWs may contain the following plotter commands:

(1) Reset and Start Write

(2) Write

(3) Sense (Basic)

(4) Sense (Switches)

(5) Start Plot

(6) No-op Control

When the channel command words have been formed, the program specifies the channel and address of the plotter. The execution of a start I/O instruction causes the command, count, data address, and control information to be stored in a specified sub-channel of the Multiplexor channel. The channel then selects the Plotter Controller and presents the command to it. If the command is valid, it is accepted. The channel then indicates to the program if the start I/O command was successful. Once the command has been accepted by the channel and the Plotter Controller, the CPU (Central Processing Unit) is unaware of the continuance of the operation until the entire data area has been transmitted.

As a part of the initial selection sequence, the Model 110 presents a status byte to the channel to indicate one of the following:

(1) Manual interrupt

(2) Outstanding status

(3) Channel end status

(4) Device end status (plotting completed)

(5) Unit check

If unit check is indicated, the Model 110 presents a sense byte indicating one of the following:

(1) Plotter not ready (600, 700 and 800 series)

(2) Bus out parity error

(3) Core buffer parity error (when provided)

(4) Overrun (channel did not respond in time to service the Model 110, unbuffered basic model, with 700 series plotter attached)

(5) Low paper (option)

(6) Plotter limit switch actuated (option)

If the manual interrupt status is indicated, this normally signifies that a sense switch entry was made and the Model 110 presents a second sense byte to the channel indicating the status of the sense switches.

These switches provide simplified and improved efficiency of operation for the on-line plotting system. The programmer may assign various functions to the sense switches, as described previously.

Because the channel contains all necessary information relative to current operation, data transfer between the main storage and the Model 110 can be overlapped with the CPU processing. The extent of overlap depends upon the type of channel (Multiplexor or Selector) and the processor (Model 30, 40, 50, etc.) of the System/360.

## Model 110 with Core Buffer

The core buffer options provide storage of 2048 or 4096 characters at the input to the plotter, and offer a significant increase in efficiency and flexibility of operation. These options permit operation on the Selector channel, or on the Multiplexor channel in the burst mode. Burst mode operation provides maximum efficiency.

"Burst" loading of the core buffer may be accomplished in bursts of any size, in random fashion, through command chaining of "WRITE" CCWs. When the buffer is full enough to warrant initiation of buffer-readout to the plotter, the computer executes a "start plot" CCW. During this time, the buffer outputs its contents to the plotter at the appropriate plotter rate. Device end status response triggers new CCWs if desired.

## Model 110 with Dual Channel Feature

This option provides a modified output section in the Model 110 to permit simultaneous, independent operation of two CalComp plotters. The dual channel feature switches alternate input characters to the channel A and channel B outputs. Two different plotter models may be connected to the A and B outputs if desired, including a 700 series plotter operating in the Zip Mode (high-speed, synchronous plotting). A manual selector switch establishes the output mode—channel A only, channel B only, channels A and B in parallel, or dual-channel operation. The selector switch also establishes the output data rate to the plotters, which is the maximum incremental speed of the slower plotter when parallel or dual-channel operation is used. For example, if a Model 565 and 763 are multiplexed, both will run at the Model 565 speed of 300 steps per second. (In this example, the Zip Mode speed of the 763 plotter would be 3.75 x 300, or 1125 steps per second maximum.) Suitable pen delays are provided by the computer plot package. Pen delays in non-multiplexed mode may be provided either by the plot package or by the Model 110 as controlled by a toggle switch on the unit.

Two plotter output terminations are provided in each plotter channel, so that with the dual channel feature, the Model 110 is capable of driving as many as four plotters simultaneously. The two plotters connected to the same channel output must be compatible, and both receive the same data. All plotters are compatible with any other plotter in its series (e.g., Model 502 and 563), and 600 series plotters can be connected with either 500 or 700 series models.
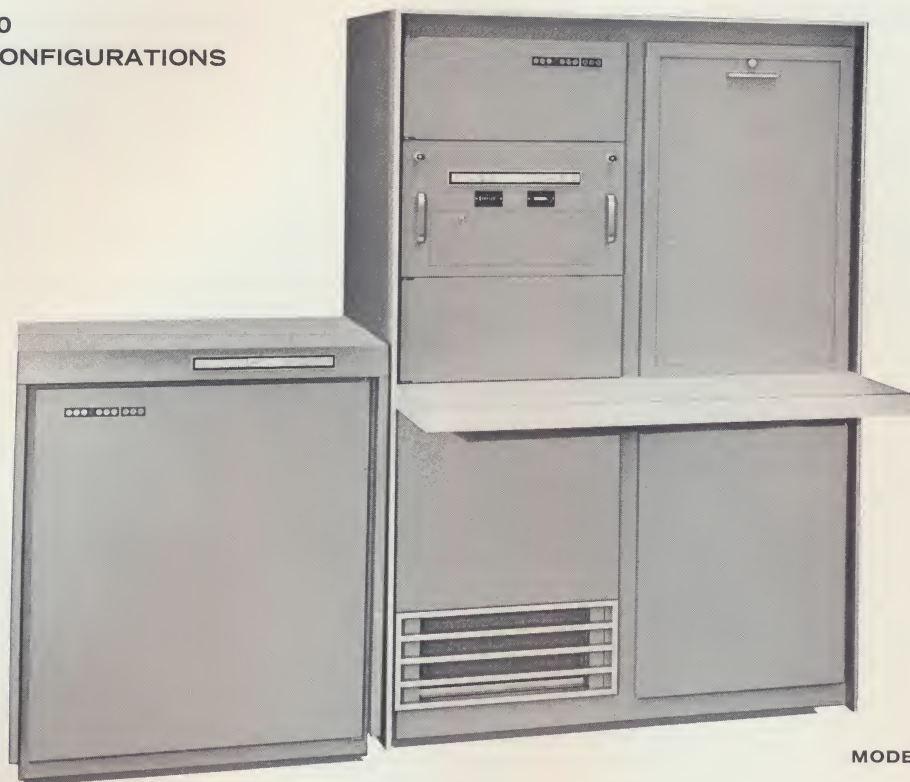
## On-Line Operation with 700 Series Plotters

The CalComp 700 series digital plotters incorporate an exclusive Zip Mode which permits very high speed plotting (up to 3.75 times the maximum incremental speed) of straight lines. However, since synchronous operation is required, the timing factor must be considered when a 700 series plotter is used with the basic Model 110, which contains only a single character buffer. Data must be supplied to the Model 110 in this case at the rate of one character approximately every 2 milliseconds. Thus, if the timing on the System/360 Multiplexor channel is critical, one of the core buffer options should be included in the Model 110. In general, the basic Model 110 should be used with 700 series plotters only when there are no disk storage or tape units operating on the same Multiplexor channel.
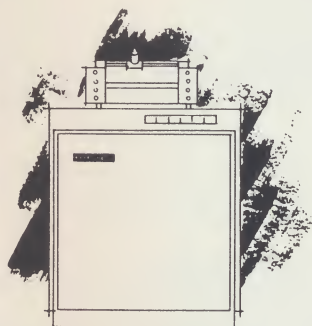
## On-Line Operation with Model 835 Electronic Digital Plotter

The CalComp Model 835 Electronic Digital Plotter provides automatic, ultra high-speed recording of a cathode ray tube plot display on 35 mm microfilm. When used for on-line plotting with the Model 110, the Model 835 has a maximum plotting speed of 100,000 incremental steps per second. The plot area, at optimum magnification of 15X, is 11 by 17 inches. Up to 3200 plots may be recorded on a single 400-foot reel of microfilm. A plot viewer which provides magnification to 11 by 17 inches is also offered as an option.
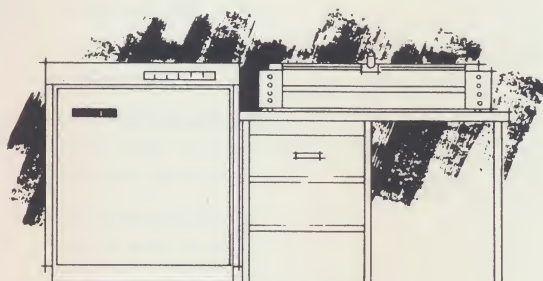
**MODEL 110**
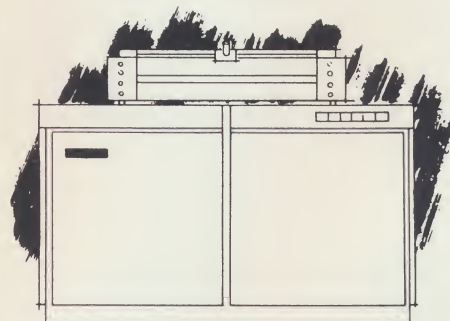**SYSTEM CONFIGURATIONS**

MODEL 110/835

MODEL 110/565

MODEL 110/563

MODEL 110/765 OR 763

MODEL 110/765 OR 763 CABINET OPTION
(ALSO AVAILABLE FOR 563, 665 OR 663)

# SPECIFICATIONS FOR MODEL 110

| DIMENSIONS: | | Standard Unit | Expanded Unit* |
|---|---|---|---|
| | Width | 32 in. | 62 in. |
| | Depth | 22 in. | 22 in. |
| | Height | 37½ in. | 37½ in. |
| WEIGHT: | | 180 lbs. | 430 lbs. |

OPTIONS:  I    **2048 Character Core Buffer**—Plug-in module containing necessary core planes, selection and inhibit drivers, address registers, and sense amplifiers.

II    **4096 Character Core Buffer**—Same as Option I with double the storage capacity.

III    **Dual Channel Feature**—Modular option to provide two plotter channels which can be driven simultaneously in a synchronous mode. Data channels may be driven in parallel (identical data on each channel) or interlaced (alternate characters on each channel). Provides proper timing and control through a selector switch. Allows intermixing of 500, 600, and 700 series plotters on separate channels. When operating in dual channel mode, output data rate to each channel is the rate of the slowest attached plotter. Channel selection switch provides the following control positions:

> Output to Plotter Channel A
> Output to Plotter Channel B
> Parallel Output to Channels A and B
> Interlaced Output to Channels A and B

This feature available with basic unit or in combination with Option I or II.

IV    ***Expanded Unit**—Includes provisions for electronics modules for 600 or 700 series plotters.

V    **Data Cables**—2 required; available in 20 ft., 25 ft., or 30 ft. lengths.

INPUT DATA RATE:  **Basic Unit**—Data transfer rate is under control of Plotter Controller and limited to maximum plotter rate.

**Buffered Unit (Option I or II)**—Data transfer rate is at maximum burst mode rate of 250 kHz when connected to Multiplexor channel. Data transfer rate is 330 kHz maximum when connected to Selector channel.

**Dual-Channel (Option III) Unbuffered Unit**—Data transfer rate is twice the rate of the slowest plotter attached, controlled by the Model 110.

POWER:  50/60 Hz, 208 volts, single phase power, approximately 500 watts, plus plotter requirement. Optional input power: 115, 190, or 230 vac, single phase.

## DIGITAL PLOTTERS

CalComp offers a complete line of digital plotters—a total of ten basic models for computer controlled preparation of quality ink-on-paper graphic presentations. All are suitable for either off-line or on-line operation.

## 500 Series

The CalComp 500 series includes two drum and two flatbed types, each available in a choice of incremental step sizes. Maximum incremental step rates are from 200 to 450 steps-per-second, depending upon the model. Each step, under program control, may be in any one of 8 directions.

## 600 Series

The CalComp 600 series includes two drum types, with optional incremental step sizes. These units are program-compatible with both the 500 and 700 series plotters. The 600 series plotters operate in either full-step or half-step mode, at incremental rates up to 900 steps-per-second in the half-step mode.

## 700 Series

The CalComp 700 series includes two drum and two flatbed types, with optional step sizes. The 700 series plotters operate at incremental step rates up to 450 steps-per-second, and include the exclusive Zip Mode®

for driving the plotter at several times the maximum incremental speed. Another feature is the "electronic gear-shift" which permits either full-step or half-step operation, or a combination of the two, for improved resolution. This capability results in 24 basic plot steps.

## ELECTRONIC PLOTTING

The CalComp Model 835 is a CRT/microfilm plotting system, precision engineered to provide ultra high-speed plotting and recording of any computer output data that can be converted to graphic form. Unlike whole-value CRT systems, the Model 835 is a true digital incremental plotter—utilizing the basic design principles and circuitry developed, perfected and patented by CalComp. When operated on-line with the CalComp Model 110, the Model 835 may be used in a time-shared configuration with other on-line equipment, and is capable of accepting input commands at rates up to 100,000 characters per second. The standard model is supplied with a 35 mm microfilm camera. A 16 mm camera is offered as an option. An optional film viewer is also available with the system.
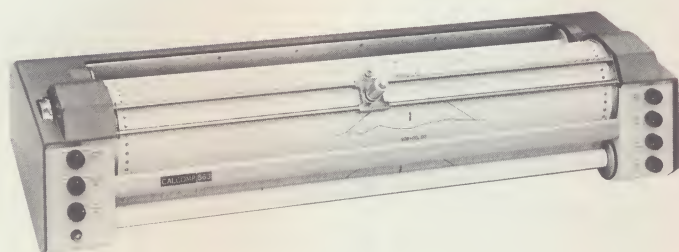
## DRUM TYPE

CalComp drum type plotters are available in two sizes: a 12-inch drum and a 30-inch drum. The plot is produced by rotary motion of the drum (X-axis) and lateral motion of the pen carriage (Y-axis). Either ballpoint or liquid ink pens may be used. The drum type plotter uses special chart paper rolls and can produce continuous plots up to 120 feet in length. A wide selection of paper is available.

## FLATBED TYPE

CalComp flatbed plotters are also available in two sizes: 31 by 34 inches, and 54 by 72 inches (plot area). The plot is produced by lateral motion of the beam and vertical motion of the pen carriage. Either ballpoint or liquid ink pens may be used. The flatbed plotter provides continuous display during plotting. It does not require special paper, and can handle a large variety of preprinted forms and special materials.

| | |
|---|---|
| 12-Inch Drum | Model 565 |
| | Model 665 |
| | Model 765 |
| 30-Inch Drum | Model 563 |
| | Model 663 |
| | Model 763 |
| Plot area 31 x 34 | Model 502 |
| | Model 702 |
| Plot area 54 x 72 | Model 518 |
| | Model 718 |

FOR ADDITIONAL INFORMATION
CONTACT CALCOMP MARKETING
OR YOUR LOCAL SALES REPRESENTATIVE

CALCOMP

CALIFORNIA COMPUTER PRODUCTS, INC.
305 North Muller Street    Anaheim, California 92803
Phone (714) 774-9141    TWX 910-591-1154

*575*

*PRELIMINARY PRODUCT NOTE*

# MODEL 575 DIGITAL INCREMENTAL REMOTE PLOTTER (DRUM TYPE)

## C A L C O M P



The CalComp Model 575, designed to interface with a standard telephone company DATA-PHONE device, provides for high-speed digital incremental plotting of digital computer output at remote locations — either nearby or thousands of miles from the data source. Similar to CalComp's Model 565 Digital Incremental Plotter but with the added capability of built-in electronics which allow it to accept serial data via remote communication lines, the Model 575 also features a drum limit switch that permits the drum to be indexed to a unique position.

## SPECIFICATIONS

| Type | DRUM |
|---|---|
| Maximum plot size: Y-axis | 11" |
|                    X-axis | 120' |
| Incremental step size: | .010" |
| Maximum incremental speed in steps/second: | 300 |
| Inputs | 1. 201A or B DATA-PHONE<br>2. STANDARD 500 Series parallel "pulse" input |
| Power Requirements | 1Φ, 50-60 Hz, 105-125V<br>1.6 amps at 115 V |
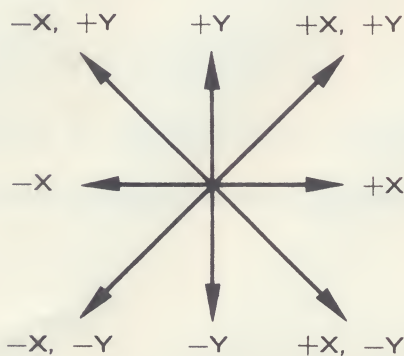


**BASIC STEPS: 500 SERIES PLOTTERS**

Completely digital, high-resolution remote plotting.

Maximum incremental rate 300 steps-per-second.

Fully automatic, unattended operation.

No paper alignment required.

Wide paper selection, plain or preprinted rolls.

Liquid ink or ballpoint pens available.

Plotting area 12 inches by 120 feet.

## PRINCIPLES OF OPERATION

The Model 575, which interfaces with DATA-PHONE Subsets 201A or 201B, is designed to take full advantage of its data handling capacity. At any place where there are adequate telephone facilities, the CalComp plotter will receive computer output data either as a single unit or as part of a conference hook-up employing a number of such remote plotters.

The remote plotter unit is capable of accepting an eight-bit serial Command Word, sequenced by list as follows:

     Start Pulse
     +Y
     +X
     −Y
     −X
     PEN UP/DOWN
     STOP BIT
     STOP BIT

Thus, with the 2400 BPS capability of the 201A, the Model 575 operates at 2400/8 or 300 commands/second.

The presence of −Y and +Y in the same data word is interpreted as a turn-on code. Following the turn-on code, the plotter will interpret and obey all command words until either the carrier detector signal from the subset falls or a turn-off code (±X command in same data word) occurs. For example, the plotter may be "turned off" between plots so that extraneous noise will not disturb previously plotted information.

One of several models in the CalComp 500 series, the Model 575 is also suitable for automatic digital plotting with virtually any standard computer — on-line or off-line and will produce high quality ink-on-paper plots of computer output data, with unvarying accuracy. It can operate either as a remote unit or as a standard incremental plotter.

For off-line plotting capabilities, Model 575 is compatible with three CalComp Magnetic Tape Plotting Systems, Models 470, 750 and 760. CalComp also offers a wide range of interface equipment for on-line plotting. (For detailed information, contact "CalComp Marketing" or your local Sales Representative.)

# MODEL 575
# REMOTE DIGITAL PLOTTER

# CALCOMP MODEL 575 REMOTE DIGITAL PLOTTER

## INTRODUCTION

One of the most significant and rapidly growing trends in the computer industry today is the move towards centralized data processing systems, both general-purpose and specialized. Individual systems at remote locations are being replaced by input/output devices connected to the central computer by means of transmission lines. Generally, the only functions performed at the remote sites are to send data to and receive results from the central processor.

To keep pace with this important trend, CalComp has introduced the Model 575 Remote Digital Plotter, providing the same versatile, high-quality digital graphics capability for remote terminals as other CalComp systems have provided for standard on-line and off-line installations for many years.

The CalComp 575 Remote Plotter is a self-contained unit which houses a plotter and dataphone adapter for interface with a voice-grade transmission line. The unit provides ink-on-paper graphics at remote locations in an unattended mode of operation. The graphic information can be transmitted rapidly, accurately and economically to a single remote terminal, or to a network of remote plotting locations. The 575 was specifically designed to function at remote sites in a data communications network.

The plotter portion of the 575 operates in the same manner as a standard CalComp 565 plotter. When the 575 is not functioning as a remote plotter, it can be operated locally at the remote station by an off-line CalComp Magnetic Tape Unit or on-line to another computer at the remote location. In either environment, remote or local, the 575 can operate at the full incremental rate of 300 steps-per-second.

# SYSTEM OPERATION

The 575 Remote Plotter interfaces with a voice-grade transmission
line through a Bell System 201A or B DataPhone.  An 8-bit code trans-
mitted at 2400 bits per second is accepted serially and decoded into
plotter commands.  This 8-bit code is composed of 1 start bit, 5
data bits and 2 stop bits.  The 575 can be interfaced with any
computer which meets the transmission requirements of the system.

All CalComp 500 series Digital Incremental Plotters operate on the
same basic principle.  Bidirectional step motors are used for the X
and Y axes and the plot is produced by movement of a pen relative to
the surface of the recording paper.  Each input command produces one
incremental step in the X or Y axis, or a combined X and Y movement,
in either the positive or negative direction.  Additional commands are
used to raise or lower the recording pen.

When the digital plotter is used in an off-line system, the plot data
and associated control commands are prerecorded on magnetic tape.  The
tape is then played back on a CalComp magnetic tape unit.  The tape
unit includes control logic circuits which locate the plot data on the
tape, and decoding circuits which supply the X and Y axis drive signals
to the plotter, and the pen-up or pen-down (Z-axis) commands.

When the plotter is used in an on-line system, the plot data and
control commands are supplied directly to the plotter through a CalComp
Plotter Controller or adapter, or through interface electronics supplied
by the computer manufacturer.

Two important aspects of the 575 for unattended operation are the
indexing and automation on-off features.

The indexing capability allows a user, no matter where the pen is
located or how the drum is positioned, to index the pen and drum to a
unique position in preparation for the next set of plot data to be
sent to the remote location.  These features are especially important
if preprinted paper is used.

The automatic on-off feature permits the plotter to be turned on from
the central computer before plot data is transmitted, and to be turned
off after the operation has been completed.

The following block diagram shows the three possible system configura-
tions for the 575.

```
                          ┌─────────────────────┐
                          │      COMPUTER       │
                          │ - - - - - - - - - - │
                          │   COMMUNICATIONS    │
                          │     CONTROLLER      │
                          └─────────────────────┘
   CENTRAL                          │
   PROCESSOR                        ▼
                          ┌─────────────────────┐
                          │                     │
                          │      DATAPHONE      │
                          │                     │
                          └─────────────────────┘
                                    │
                          TRANSMISSION
                             LINES
                                    │
                                    ▼
                          ┌─────────────────────┐
                          │                     │
                          │      DATAPHONE      │
                          │                     │
                          └─────────────────────┘
   REMOTE                            │
   TERMINAL                          ▼
                          ┌─────────────────────┐
                          │     DATAPHONE       │
                          │      ADAPTER        │
                          ├─────────────────────┤
                          │      PLOTTER        │
                          └─────────────────────┘
```

CENTRAL
PROCESSOR

COMPUTER

COMMUNICATIONS
CONTROLLER

DATAPHONE

TRANSMISSION
LINES

DATAPHONE

REMOTE
TERMINAL

DATAPHONE
ADAPTER

PLOTTER

COMPUTER

CALCOMP
ON-LINE
CONTROLLER

CALCOMP
OFF-LINE
MAGNETIC
TAPE
UNIT
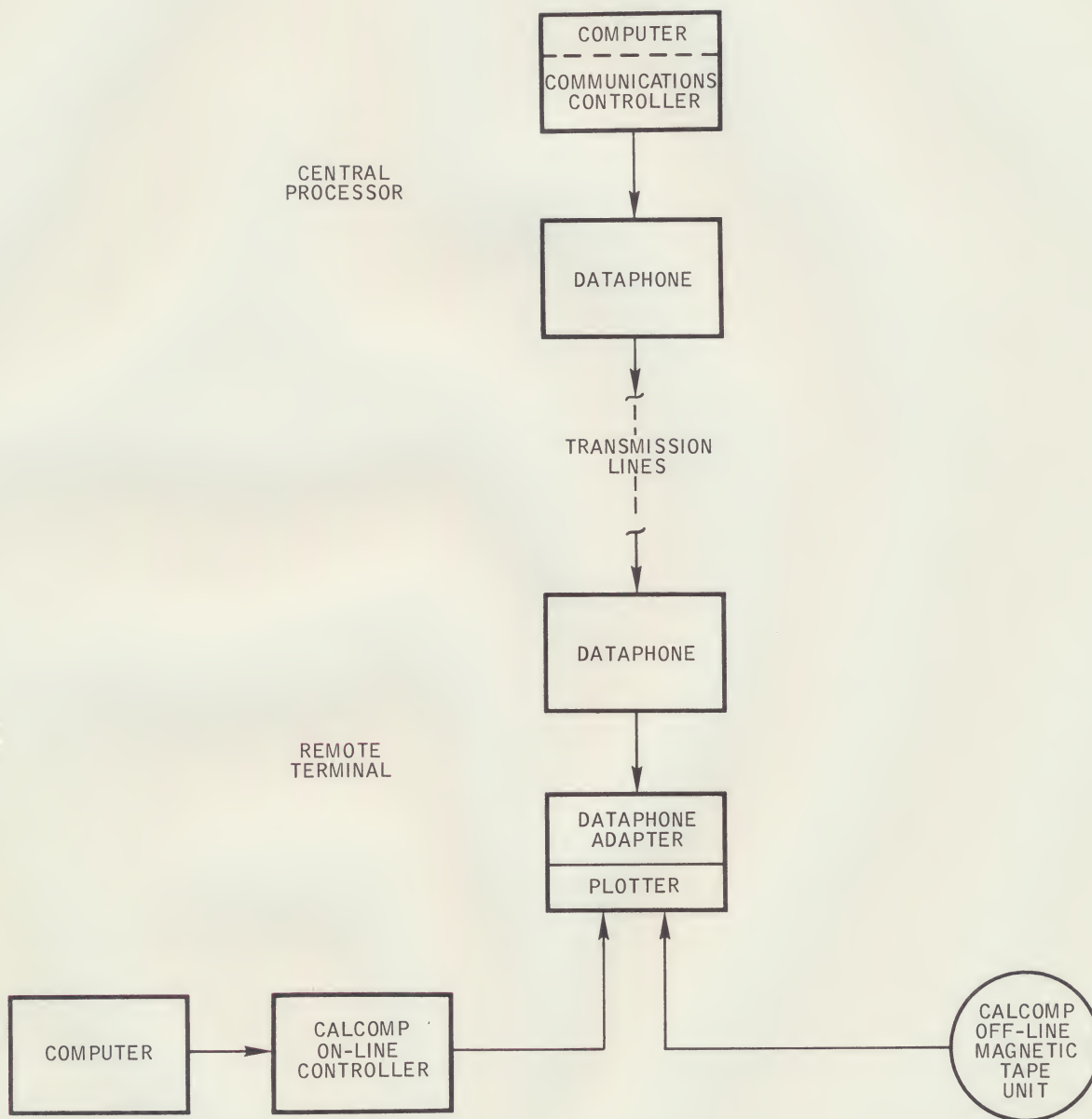
SYSTEM CONFIGURATION FOR MODEL 575

## SOFTWARE

CalComp catalog Basic Software is available for most computers and will be supplied for the 575 under the Standard CalComp Software Agreement. When the 575 is used as a remote plotter, the plot subroutines must be interfaced with the data communications executive program by the user. For local operation, standard CalComp software can be used directly without further modification.

## COSTS

The cost of the 575 for remote operation is $5,863. This does not include charges for dataphones and transmission line services which are also required for remote plotting system operation.

In order to operate on-line to another computer at the remote site, a CalComp Controller is required, at an additional cost of $6,500.

For the capability to operate off-line at the remote site, any one of the following CalComp Magnetic Tape Units can be used:

| Unit | Price |
|------|-------|
| 470 | $15,100 |
| 750 | 21,200 |
| 760 | 28,500 |

## APPLICATIONS

The CalComp 575 Remote Plotter gives a user the ability to produce meaningful graphic output at remote locations at very high speed. The plot data can be sent to the remote site on a scheduled basis or as the result of an inquiry from the distant location.

One user of the 575 on a scheduled basis is to plot weather maps at outlying locations, a system pioneered by the U.S. Navy Fleet Numerical Weather Facility. New data is continually gathered and analyzed by the central computer. At a predetermined time, the latest information is transmitted to the remote location where the CalComp 575 plots the latest weather map on preprinted chart paper.

APPLICATIONS (Continued)


Another advantageous application of the 575, in an inquiry-oriented
system, would be a computer-based centralized file of engineering
drawings.  This file would contain the latest versions of all drawings.
Engineers at remote locations would trigger inquiries (either a tele-
phone call or via a keyboard device on a line separate from the 575)
and the desired drawing would be sent to the 575 and plotted at high
speeds.

Another application of the 575 is in the area of data reduction where
tests and other evaluation procedures must be made at a remote location.
The 575 provides the ability to transmit these results to a user loca-
tion with the results immediately accessible in graphic form.  For
such a use, the 575 has the advantages of unattended operation, re-
sults as they happen at remote locations, 120 feet along the X-axis,
and the ability to handle large volumes of output.
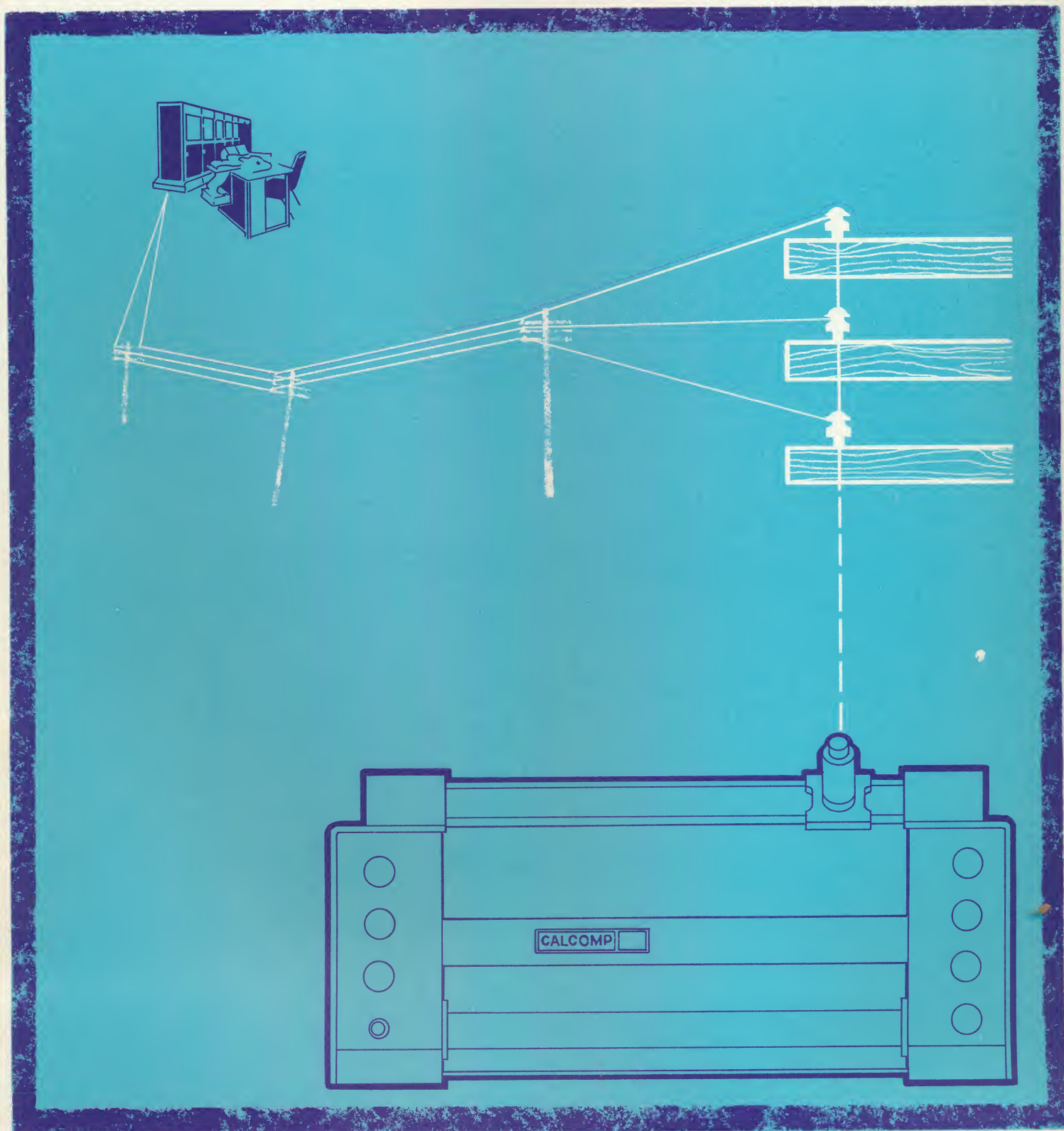
                                 SUMMARY


    The flexibility and versatility of CalComp plotters as digital
graphics output devices to computer systems has been thoroughly demon-
strated for many years.  Now, with the 575, the performance and
reliability of these CalComp plotting systems are available to meet
these needs for users at remote locations.

J.McCarthy/dl
April 1967

# REMOTE

## DIGITAL GRAPHIC SYSTEMS

CALCOMP

REMOTE

DIGITAL GRAPHIC SYSTEMS